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REPORT

OF

THE COMMISSIONERS

APPOINTED TO INQUIRE INTO THE

SANITARY STATE OF THE ARMY IN INDIA;

WITH

PRÉCIS OF EVIDENCE.

Presented to both Houses of Parliament by Command of Her Majesty.

LONDON:
PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

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COMMISSION.

Victoria, by the Grace of God of the United Kingdom of Great Britain and Ireland, Queen, Defender of the Faith.

To Our right trusty and well-beloved Councillor, the Right Honourable Sidney Herbert, and to Our trusty and well-beloved Robert John Hussey Vivian, Knight Commander of the Most Honourable Order of the Bath, a Major-General in our Indian Forces, and a Member of the Council of India; Proby Thomas Cautley, Knight Commander of the Most Honourable Order of the Bath, a Colonel in our Indian Forces, and a Member of the Council of India; Thomas Alexander, Companion of the Most Honourable Order of the Bath; Edward Harris Greathed, Companion of the Most Honourable Order of the Bath, a Colonel in our Army, William Farr, M.D., James Ranald Martin, Esquire, and John Sutherland, M.D., greeting:

Whereas it hath been humbly represented to Us that, considering the great importance of maintaining and improving the Health of all ranks of Our Army serving in India, it is expedient that certain Inquiries should be made:

Now know ye, that We, having taken into Our Consideration the Premises, do hereby order and direct you, the said Sidney Herbert, Sir Robert John Hussey Vivian, Sir Proby Thomas Cautley, Thomas Alexander, Edward Harris Greathed, William Farr, James Ranald Martin, and John Sutherland, to inquire, firstly, into the Rate of Sickness and Mortality, and Invaliding among

Our Troops, both of the General and Indian Services, in all Stations throughout India and its Dependencies; and into the class of Diseases from which such Sickness and Mortality arise.

And, further, We do order and direct you to inquire into the Causes of such Sickness and Mortality; whether as relates to Climate, Locality, state of Barracks, Drainage, Water Supply, Diet, Drink, Dress, Duties, or Habits of Troops.

And, further, We do order and direct you to inquire into what existing Stations are unhealthy, and to indicate how such Unhealthiness may be removed, if possible, and the nature of the Sanitary Improvements required.

And, further, We do order and direct you to inquire into the subject of Healthy Positions generally, with the view of recommending the most healthy for future Occupation, and of ascertaining whether healthy Stations may not be found within moderate Distance of such existing unhealthy Stations as may be of Political or Military Importance; also into the general subject of Sanitaria and Hill Stations, with the view of pointing out the most healthy Positions on them.

And, further, We do order and direct you to inquire as to the best Construction of Barracks, Huts, Hospitals, and Tents for India.

And, further, We do order and direct you to inquire into the present Regulations or Practice for preserving the Health of the Troops, and enforcing Medical and Sanitary Police.

And, further, We do order and direct you to inquire into the present Organization of the Army Sanitary and Medical Service.

And, further, We do order and direct you to inquire as to the Practicability of establishing a general system of Military Statistics throughout India, and to ascertain whether any, and what Means exist, of comparing the Diseases and Mortality of the Troops with those of the Civil Population, English and Native.

And, We do further command and require you to Report what Changes you may consider it expedient to make in the present Practice, with respect to any of the Subjects above mentioned.

And, it is Our further will and pleasure that you, or any Five or more of you, do obtain Information touching the Matters aforesaid, by the Examination of all Persons most competent, by reason of their Knowledge, Habits, or Experience, to afford it; and also by calling for all Documents, Papers, or Records, which may appear to you, or any Five or more of you, calculated to assist your Researches and to promote the formation of a sound Judgment on the Subject, and that you, or any Five or more of you, do report to Us, under your hands and seals, your several Proceedings by virtue of this Our Commission, together with your Opinions touching the several Matters hereby referred for your consideration.

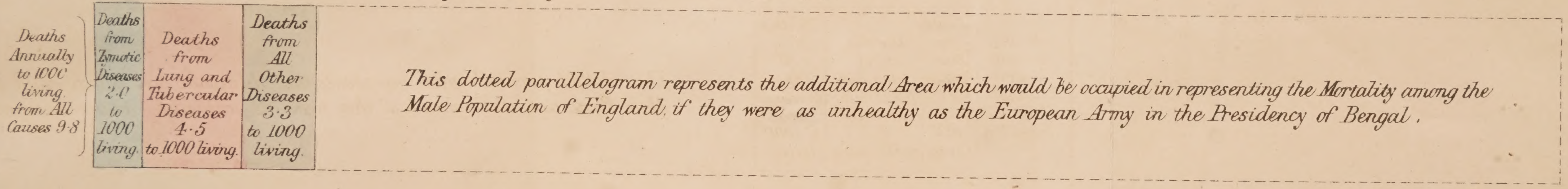
Given at Our Court at St. James's, this Thirty-first Day of May, in the Year of Our Lord One thousand eight hundred and fifty-nine, and in the Twenty-second of Our Reign.

By Her Majesty's Command.

(Signed) STANLEY.

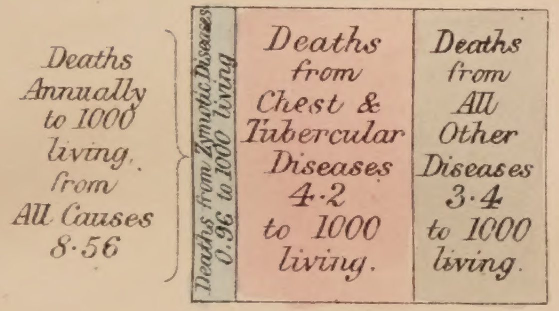
DIAGRAMS — REPRESENTING THE RELATIVE ANNUAL MORTALITY FROM ALL CAUSES, ZYMOTIC DISEASES, LUNG AND TUBERCULAR DISEASES AND OTHER DISEASES IN THE MALE POPULATION OF ENGLAND AGED 15-45, IN THE INFANTRY OF THE LINE SERVING AT HOME, AND IN THE EUROPEAN ARMY IN THE PRESIDENCY OF BENGAL.

I. *Male Population of England aged 15-45 — 1848-54.*

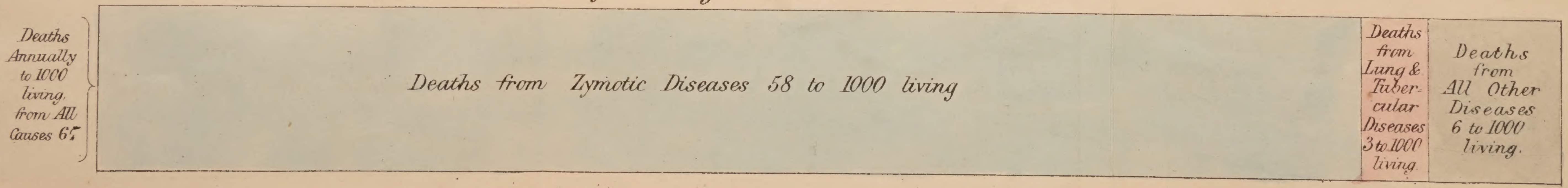


This dotted parallelogram represents the additional Area which would be occupied in representing the Mortality among the Male Population of England, if they were as unhealthy as the European Army in the Presidency of Bengal.

II. *Infantry of the Line serving at Home — 1859-61.*



III. *European Army in the Presidency of Bengal — 1830-45.*



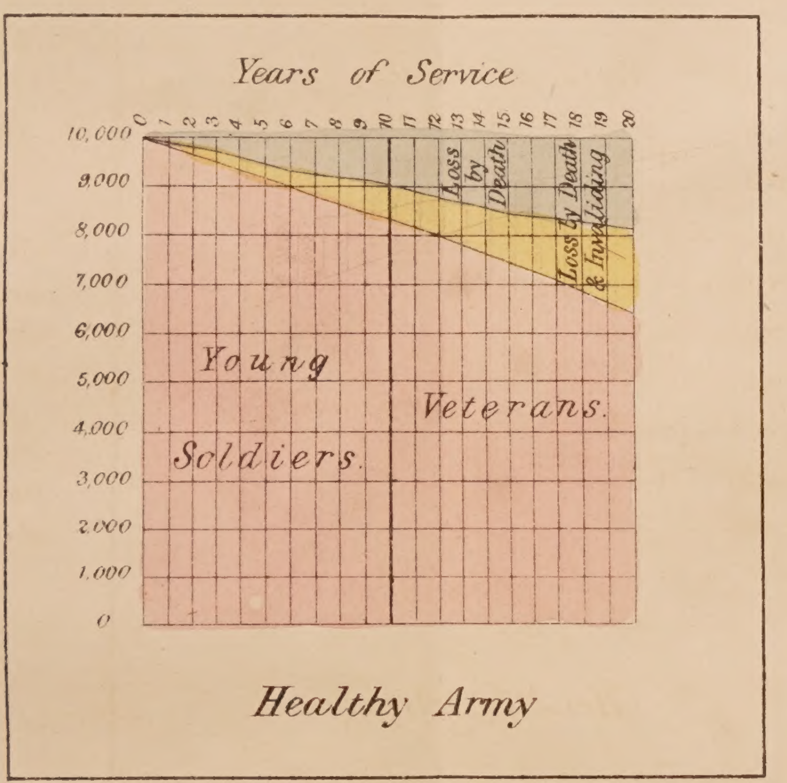
The Lung and Tubercular Diseases comprise all those included in the Tubercular and Chest Diseases (exclusive of Heart Diseases) of the Classification adopted by the Registrar General of England.

Diagram No. 3. is constructed from a Table showing the Diseases of the European Forces in the Presidency of Bengal for the 16 Years 1830-45. (see miscellaneous Tables p. 546)

Day & Son Lithrs to the Queen

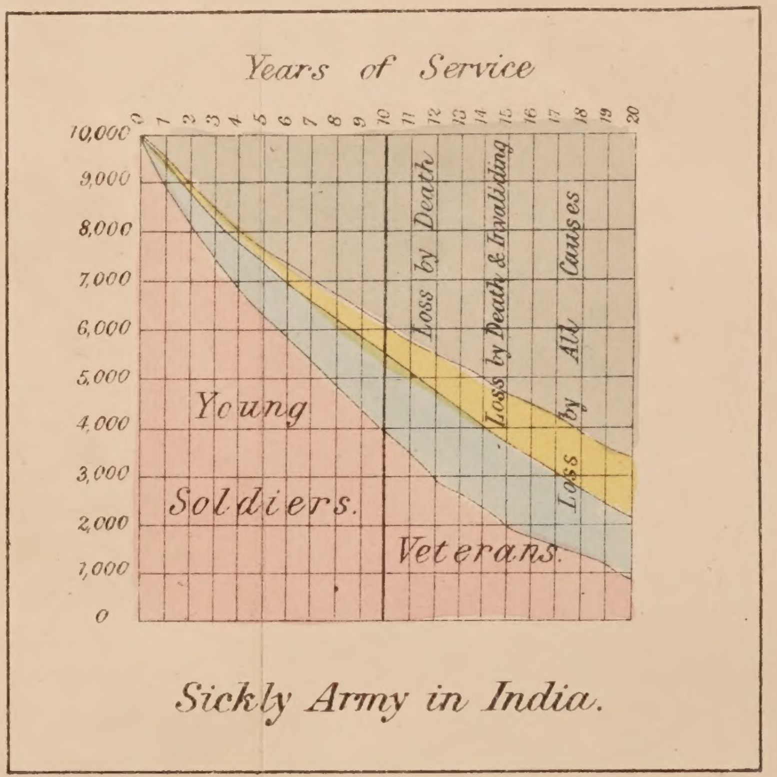
DIAGRAMS — SHOWING THE LOSS OF STRENGTH IN THE ARMY AT HOME, AND IN THE EUROPEAN ARMY IN INDIA BY DEATH, BY DEATH AND INVALIDING AND BY DEATH, INVALIDING AND ALL CAUSES.

I. Representing the Army at Home if the Mortality were the same as it is in the Male population of England at corresponding Ages.



Note. *The dark parts of the Diagrams represent the Areas of the Graveyards filled by the two Armies in the same time, under the assumed conditions.*

II. Representing the European Army in India.



The Force 166,910 represented by the Red Area in Diagram I. is assumed to be maintained by 10,000 Annual Recruits, which if there were no loss by Death or by Invaliding would sustain a force of 200,000 men, represented by the whole of the square. The loss of Strength shewn in Diagram I. is equal to 33,090 or 17 per Cent; in Diagram II. to 88,815 or 44 per Cent, if no other loss were sustained than by Death and Invaliding. The Dark Area represents the loss of Strength by Death. The Dark and Yellow Areas represent the loss of Strength by Death and Invaliding. The Dark, Yellow, and Blue Areas in Diagram II. represent the loss of Strength by All Causes. It will be borne in mind that many of the Invalided die soon after leaving the Army.

10,000 Annual Recruits in Diagram I. would sustain a force of 166,910. In Diagram II. 10,000 Annual Recruits would sustain a force of 111,185 if there were no loss from any other Cause than Death and Invaliding.

Each of the 200 small parallelograms represents 1000 men.

Day & Son Lith^rs to the Queen.

REPORT.

TO THE QUEEN'S MOST EXCELLENT MAJESTY.

May it please Your Majesty,

We, the Commissioners appointed to inquire into the sanitary state of Your Majesty's Army serving in India, humbly present to Your Majesty the results of our investigation, which we do in the [illegible] Report, as follows:—

The inquiry in which we have been engaged has been one of unusual extent and duration, and from its nature has led to considerable delay in preparing our Report. We had, in the first place, to lay the foundation for our inquiry by an elaborate examination of the available statistical and sanitary documents in the India House. In doing so it was perceived at the very beginning that we could not arrive at our object by taking oral evidence only, and that it would be necessary to carry out a preliminary local inquiry at all the Indian stations before a true estimate could be formed of what were the real conditions of the problem with which we had to deal. With this view a series of printed questions was drawn up and sent to all the stations to be there replied to and signed concurrently by the commanding, engineering, and medical officers. We had to await the results of this part of the inquiry; and as on some important statistical points the replies from two Presidencies were incomplete, we called for further information, which has not yet been received by us. This, together with other engagements of members of the Commission, has led to considerable but unavoidable delay, which we are grieved to say has been increased by the losses which the Commission has sustained since its first meeting. The late Lord Herbert, who was the first Chairman, was compelled by official occupation, and latterly by declining health, to suspend the meetings for some time. Previous to that period Sir Robert Vivian had been obliged by his other duties to resign as member of the Commission; and we had further to deplore the death of Mr. Alexander, the late Director-General of the Army Medical Department. To supply these losses, Dr. Gibson, the present Director-

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General, and Colonel Durand, since called to India, were added to the Commission, and Lord Stanley consented to succeed Lord Herbert as Chairman.

We have thought it necessary to make this statement to account for the lengthy period which has intervened between the date of Your Majesty's Commission and the date of this Report.

An inquiry extending over so large an area, and including so great a multiplicity of details, many of them of a minute character, has been necessarily voluminous and expensive; but the evidence which it has called forth appears to us to be so important, not only to the interests of troops serving in India, but to those inextricably interwoven with them of the native population, that we have not scrupled to publish it for official use, partly for the purpose of spreading information, and partly in order that the correctness of the statements made by us might be fully sustained by authority.

Appended to the Report, we have given a précis of the evidence; and, separately, the oral evidence,* with some important addenda made to it by the witnesses,
P. 371. an abstract of all the stational reports,† and a valuable
P. 347. paper of comments on these reports, contributed, at the request of the Commission, by Miss Nightingale.

P. 527. The medical statistics for the troops of the late East India Company, and also for those of the Royal army (the latter prepared at the Army Medical Department), which follow, have been drawn up from the best available data, supplied partly from India, partly by His Royal Highness the Commander-in-Chief, and by the Secretary
P. 781. of State for India. These, together with a paper on the geographical distribution of Indian climates prepared at our request by Mr. Glaisher, contain the main statistical facts of the inquiry. Involving a wide range of subjects, our researches have been minute, and the evidence by which our conclusions are borne out is necessarily voluminous. But we believe that the abstracts referred to contain the substance of all the facts in such a form as to render reference to the evidence almost needless,

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* The evidence, &c. is set out at length in a separate folio volume, printed for official use, and the figures here placed in the margin refer to the page or number of question in such folio, except the references to pages of this report placed within brackets, and marked *ante* or *post.* [See note p. 201 *post.*]

† These reports from Indian stations given in full form a second folio, or "Appendix to Evidence."

except for the purposes of verification and more minute analysis. It has been our object to present a large mass of facts and detail within as limited a compass as the nature of the questions we have discussed allowed.

In dealing with the evidence we have considered it best to arrange the facts it contains in distinct divisions, beginning with the statistics of mortality and disease. Under this head we have given,—

The strength and distribution of the army in India.
The total mortality among British troops, and at different ages and periods of service.
The annual waste of life in each year of service.
Nature of the diseases occasioning the mortality and the loss of efficiency from sickness.

We next give an estimate of the cost of placing the soldier in India, and the pecuniary loss occasioned by the present death and sick rate.

This discussion is followed by a statistical estimate of the mortality among native troops, among natives, and among Europeans and mixed races in India.

Following on this general statistical investigation we next give the results of our inquiries into the mortality of particular groups of stations.

Having in this manner arrived at the facts regarding mortality and disease we next proceed to examine into the influences affecting the health of European troops, as these are described in the evidence and stational reports.

Under this part of the inquiry we have included a general discussion on the topography and climate of India,

The sanitary condition of stations, towns, and bazaars.
Drainage and water supply.
Construction of barracks, together with the state of their ventilation, cubic space per man, ablution and bath accommodation, cook-houses, latrines, &c.
Accommodation for officers and married soldiers.

Having considered the questions arising out of the soldier's barrack accommodation we proceed to discuss the influence of his diet, dress, and duties. Next the very important subject of intemperance and its concomitants in their influence on health and efficiency, and the amount and kind of occupation and recreation provided for the soldier to fill up his spare time.

This is followed by an inquiry into the state of the hospital accommodation, including the questions of construction, ventilation, cubic space, drainage, water supply, hospital conveniences, and attendance.

The very important question of hill stations follows next in order.

And, lastly, the sanitary condition of native lines and hospitals.

Having completed our survey of the causes of sickness and mortality we consider the present state of sanitary administration in India with the improvements required to enable the causes of disease to be dealt with, and we conclude, after a recapitulation of the leading results of the inquiry, with the recommendations we have to make for improving the health of troops serving in that part of the empire.

STRENGTH AND DISTRIBUTION.

In conformity with this arrangement of subjects, we proceed, first, to discuss connectedly the facts which in this inquiry admit of numerical analysis.

Strength and Distribution of the Army in India.

Horse Guards' Return, dated 29th July 1862.

The British army consisted of 227,005 officers and men on April 1st 1861; and 82,156 of them belonged to regiments in India at that date; 144,849 to regiments at home or in the colonies. The strength of the regiments serving in India was 94,829 in the previous year.

Thus a large proportion of the regiments is in India; and a still larger number may be called to that part of the empire in great emergencies.

Four regiments in eleven were serving there; so should those proportions be maintained, and every regiment go in its turn, it will be exposed 10 years in every 27½ years, or four years in eleven, to Indian influences. But as some corps never go to India, the service will fall more heavily on the rest.

The full establishment of a royal regiment in India was 1,119,* including 41 officers, 138 non-commissioned officers and drummers, 940 privates. And of this strength about 220 of each regiment in India figured in the depôts at home.

Horse Guards' Return.

The distribution of the army at the latest date (April

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* See Colonel Baker's Paper, No. 52, Appendix to Report of Commission to inquire into Organization of Indian Army.

STRENGTH AND DISTRIBUTION.

1862), we will now give from the returns, including for Bengal the non-commissioned officers and men only.*

At this date some of the changes resulting from the incorporation of the Indian forces in the Queen's army had been carried out, and the European officers in the return amounted to 3,962, the non-commissioned officers and men to 70,489; the native officers and men to 108,382, exclusive of 11,652 men in the Punjab local force, and of numerous police corps which have been created in all the provinces.

In Bengal, the North-west Provinces, and the Punjab, that is, in the territory filling the vast plain of the Ganges and of the Five Rivers, from Calcutta and Assam to Peshawur, a force of 85,966 men were stationed, consisting of 46,290 Europeans (officers, 2,160), and 39,676 Indians.

The Presidency division extends over the whole of the populous delta of the Ganges, from the Dhumrah river to Darjeeling in the Himalayas between Nepal and Bhotan, and along the Brahmapootra to the extremities of Assam. The military force consisted of 3,593 Europeans and 6,047 natives; namely, 1,539 Europeans and 624 natives at Fort William and Alipore, covering Calcutta; 580 Europeans, 708 natives at Barrackpore; 413 Europeans at Raneegunge, 297 at Berhampore, and 319 at Dacca. The Europeans at other stations were few; a corps of 1,088 natives was in Assam. The Benares division consisted of 3,390 Europeans, and 3,198 natives; 1,075 of the Europeans were stationed at the plateau station of Hazareebaugh, 680 at Dinapore, 678 at Benares, 406 at Goruckpore, and the residue at four other stations. This populous district, by the side of the independent state of Nepal, lies around the Gunduck, and the Gogra on the north, and the Sone on the south of the Ganges, which here receives their waters.

The Saugor district, in the midst of small feudatories, has 2,243 Europeans and 4,746 Indians; of the Europeans, 874 are at Jubbulpore, and 848 at Saugor. In addition here are two native corps from the Madras presidency.

In proceeding up the Ganges, the Oude and Meerut divisions, with the Gwalior on the left, and the Rohilcund

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* There is a great want of uniformity in the returns of all the Presidencies. And for various purposes it has been necessary to use returns of different dates, sometimes supplied by the Adjutant-General, and at others by the India Office.

STRENGTH AND DISTRIBUTION.

division to the right, extending to the Himalayas, consist of a force of 18,987 Europeans and 13,391 Indians. 1,302 Europeans, 1,351 Indians, are stationed at Gwalior; 738 Europeans and 413 Indians at Jhansi. Oude is occupied by a strong force of Europeans, of whom 1,386 are at Allahabad, 1,294 at Cawnpore, 2,085 at Lucknow, 597 at Roy Bareilly, 1,256 at Fyzabad, 799 at Gonda, and 610 at Seetapore. Only 2,848 natives of India are in Oude; and 554 Europeans, 302 Indians, in the Rohilcund district, are at Shahjehanpore; 1,074 Europeans are at Bareilly, 406 at Moradabad, 241 at Nynee Tâl.

Of the troops in the Meerut division, 578 Europeans are at Futtyghur, 1,206 at Agra, 506 at Muttra, 1,165 at Delhi, 2,094 at Meerut, 632 at Roorkee (the head quarters of the Ganges canal operations), and 156 at Landour, one of the lofty hill stations.

4,874 men of the European force, and 2,524 of the native force, are in the Sirhind division, between the Jumna and the Beas; namely, 1,840 Europeans at Umballa, 263 at Jullundur, 220 at Phillour; and in the high hill districts, 630 at Dugshai (16 miles from Simla), 76 at Kussowlie, and 935 at Subathoo.

The Punjab is held by 11,043 Europeans and 9,770 of the native army. At Umritsir there are 621 Europeans, 501 natives; at Sealkote, 1,471 Europeans, near the Chenab, flowing from Gholab Sing's dominions, 1,266 at Lahore, 819 at Ferozepore, and 1,171 at Mooltan. At the three latter stations, 3,221 men of the native army are located.

The Peshawur district of the Punjab, lying against the Khyber Pass and Afghanistan, is held by 157 Europeans at the station on the Jhelum flowing from Cashmere; 1,438 at Rawul Pindi, 214 at Attock on the Indus, and 711 at Nowshera, near Peshawur, which is itself occupied by 2,027 Europeans, and 2,849 natives.

The East India railway runs through the Bengal military divisions, and, with that of the Punjab, connects them all from Calcutta to Lahore on one strategic line, which is prolonged by the grand trunk road to Peshawur.

Another railway line extends from Allahabad on this base to Jubbulpore and Bombay, nearly parallel to the remoter line going from Lahore to Mooltan.

The European forces of this command are stationed, with few exceptions, at the bottom of the Ganges plain, near the chief cities on the rivers.

STRENGTH AND DISTRIBUTION.

Descending the Indus, the Bombay Presidency is entered through the Sinde division, where 293 Europeans are stationed at Hyderabad, the summit of the delta of the Indus, and 1,219 at Kurrachee, with 841 natives at the former, 773 at the latter station. There are 83 officers, 1,512 Europeans, and 4,155 natives, including the frontier brigade in Sinde, lying between the Suliman range, with the Belochs on the north-west and the desert on the south-east.

The force in all the Bombay presidency, — including 465 Europeans, 2,380 natives in the presidency division, —consists of 12,198 Europeans and 29,681 natives. They are commanded by 852 officers.

The northern Bombay division, extending over the Cutch and Guzerat from Sinde to Poona, has 908 Europeans at Deesa on the Bunnass, 302 at Ahmedabad, 60 at Surat, and 46 on Mount Aboo, making, with the troops at two more stations, 1,318 non-commissioned officers and men, besides 5,940 natives, at the same stations, at Baroda, Bhooj, and elsewhere.

The Mhow division, of 3,478 Europeans and 4,527 natives, occupies a central territory intersected by the Aravulli and Vindhya ranges of mountains, whose waters flow into the Nerbudda and the Chumbul. The territories of Holkar, Sindia, and the warlike Rajpoots lie around the stations, of which Mhow, near Indore, is held by 1,680 Europeans, Nusserabad by 1,060, Neemuch by 564, and Ajmeer by 61. The railway from Agra to Bombay goes through this country, south of the desert, but parallel with the distant Indus.

The Poona division carries us further into the tropics, but higher over the Deccan and the Ghauts; it surrounds the presidency, and holds the ancient seat of the Mahratta power with 235 officers, 3,323 European non-commissioned officers and men, and 6,515 natives. Of the Europeans, 1,850 are at Poona, where the Peishwa resided, 438 at Kirkee, in its vicinity, 724 at Ahmednuggur, 215 at Sattara.

The Belgaum division, further south, but north of Goa, consists of 98 European officers, 1,132 men, and 3,794 natives; the Europeans being at Belgaum, the native force, with their European officers, at Dharwar, Kulladghee, Kolapore, and Vingorla.

The presidency of Fort St. George, Madras, had under its command 14,161 Europeans, besides 950 European

STRENGTH AND DISTRIBUTION.

officers, and 39,025 native officers, non-commissioned officers, and rank and file.

It had two native corps in the Saugor division, which has been before referred to, and is also occupied by troops of the Bengal force.

The Nizam, in his dominions of nearly 100,000 square miles, and more than 10,000,000 inhabitants, in the centre of the Deccan, has a considerable military array, consisting of an auxiliary force under British officers, paid by him, irregulars, and dependants of Ameers.

The British subsidiary force of 183 officers, 3,161 Europeans, 4,272 Indians, occupies cantonments at Secunderabad, near his capital, at Jaulnah, and other stations. The Nagpore force of 86 officers, 1,603 Europeans, and 2,484 native officers and men, is at Kamptee, Hoosingabad, and several detached posts, in a country which was, like Hyderabad, recently under the Rajah of Berar, and lies between the Nizam's dominions and Bengal.

77 officers, 906 Europeans, and 3,445 native officers and men occupy the ceded districts which were detached from the Nizam's territory, south of the Kistnah, by treaty. 57 officers and 902 Europeans are at Bellary.

The Northern division, chiefly of natives, is diffused on the coast country, extending from the mouths of the Kistnah over those of the Godavery and the Mahanuddy to the river Dhumrah, which separates it from Bengal. The division consisted of 65 European officers, 106 men and non-commissioned officers, 5,929 native officers and men.

The Mysore division of 229 European officers, 3,486 non-commissioned officers and men, and 7,354 native officers and men, was stationed chiefly at Bangalore, at Mangalore and Cannanore, at Mercara, at Hurryhur on the Tumbudra, and at the French Rocks. The Europeans are chiefly at Cannanore, on the Malabar coast, and at Bangalore, which is 3,000 feet above the sea level, and joins Madras by a railway. Seringapatam, Hyder Ali's capital, was abandoned on account of its insalubrity.

The Neilgherry hills are on the borders of the Mysore, and of the Southern division, which extends over all the southern extremity of the peninsula. 59 European officers 691 men, and 3,586 native officers and men are in the districts of Trichinopoly, Palamcottah, and Quilon. Trichinopoly is above Tanjore, the fertile delta of the Cauvery, on an extensive open plain.

STRENGTH AND DISTRIBUTION.

The Central division of 112 officers, 2,101 non-commissioned officers and men, and 4,076 native officers and men, occupies the stations around Madras. The Europeans are at Fort St. George, St. Thomas's Mount, and Palaveram, from which numerous detachments are sent. Two native corps are at Vellore and Arcot.

Since the Burmese wars (1826 and 1852) the province of Pegu, east of the bay of Bengal, in addition to Arracan and Tenasserim, is British territory; and the Pegu division consists of 85 European officers, 2,096 European men, and 4,561 native officers and men. The Europeans are at Rangoon, in the delta of the Irawaddy, at Thayet Myo above Prome, on the same river, and at detached posts; some of them on the Madras side of the bay of Bengal. The native corps are at Tonghoo and Moulmein.

At the extremity of the Malay peninsula, native corps of the Indian army, consisting of 18 European officers and 1,378 men, occupy the Prince of Wales's island and Singapore, which command the Malacca straits, and afford the protection of the British flag to the surrounding people and to the commerce of China.

A native corps of 14 European officers and 938 men, from the Bombay presidency, was in China; and the same presidency returns a small native force of 342 in the Persian Gulf, at Bushire, at Bussorah, where there were factories, and on marine duty.

A brigade at Aden, on the way to Europe by the Red Sea, consisted of 29 European officers, 584 men, and 1,053 Indian officers and men.

India has been the centre of military operations carried on in the Red Sea, in the Persian Gulf, and in the China seas; and the army, now incorporated with the army of the Empire, exists for its defence. This has necessarily to be borne in mind in the distribution of the Indian forces.

MORTALITY OF THE BRITISH TROOPS IN INDIA.

MORTALITY OF BRITISH TROOPS.

Having given this brief sketch of the present distribution of troops throughout India and its dependencies, we next proceed to show what is the rate of mortality and the effect of this on the efficiency and on the cost of the Indian army.

The medical reports, special investigations of the casualty rolls which we have had made, and a great variety of returns, supply the materials for determining the mor-

MORTALITY OF BRITISH TROOPS.

tality of the European non-commissioned officers and men in the various arms and in the presidencies.

In a spirit of providence the servants and officers of the late Company established funds for the sustenance of widows and orphans; but without adequate data, and hence it has been necessary to submit their experience to the investigation of several actuaries in London, who have at various periods reported on the mortality of the members and of the services. These reports exhibit the mortality of Indian civil servants, of military officers, of wives, widows, and children.* From another source we are able to follow the Indian officer home, and to determine his lifetime after passing through the perils of India. With the non-commissioned officers and men we can now, for the first time, deal in the same way.

The variations of the rate of mortality among men depend on two great classes of causes; the first class inherent in the organization itself, the second external. Thus, under similar circumstances, the force of life declines, the mortality per 1,000 increases year by year after the age of 15. Among females, never exposed to the risks of war or of dangerous occupations, it is 7·65 at the age of 20; 8·94 at the age of 30; 9·98 at the age of 40; 11·92 at the age of 50; 21·62 at the age of 60; 49·92 at the age of 70; and 118·66 at the age of 80 in the healthier districts of England and Wales. The increase of mortality up to the age of 50 is at the rate of about 1½ per cent. for every year of age, or 16 per cent. for 10 years; so that if the rate of mortality is 10·00 at the age of 40, it becomes 10·15 at the age of 41, and nearly 12·00 at the age of 50. After the age of 50, the mortality increases annually at the rate of 8·7 per cent., and is doubled in every 8¼ years of age.

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* We have been able to use some of these reports by Griffith Davies, and Neison, which have been published for private circulation; and have particularly to thank Mr. Samuel Brown for the MS. results of an investigation into one of the funds, bringing down the inquiry to the latest times. Major-General Hanyngton has placed a valuable table at our disposal. A valuable series of statistical returns have been collected by Sir Ranald Martin in his work on the Influence of Tropical Climates. The papers of Dr. Chevers, the digest of the vital statistics of the armies of India by Dr. Ewart, and other publications, show the interest that the medical officers of the Indian army take in the subject. The evidence of Sir Alexander Tulloch, Dr. Balfour's tables, and the second army report have been consulted. We have relied much upon the tables in the addenda to evidence which have been procured for the Commission.

MORTALITY OF BRITISH TROOPS.

Sex, and perhaps race, as well as age, are other inherent elements affecting the rates of mortality. Each age or sex is subject to a mortality which may be called natural in the present state of mankind; but that natural mortality is everywhere augmented by bad habits and unfavourable conditions. The natural standard is therefore undetermined; but the ascertained rates of mortality actually prevailing among large bodies of men will serve temporarily all the practical purposes of the exact natural standard.

Now the mortality of men of the soldier's age in the healthy parts of England and Wales is such that, on an average, 8 die annually to 1,000 living.*

Recruits for India undergo careful examination; and when soldiers are attacked by consumption, or any disease that is not soon fatal, they are invalided. So that their recorded mortality in peace, under such conditions as can be commanded for the army at home, should not exceed that experienced in the healthy districts of England, which, as regards their salubrity, are by no means perfect models.

Half the population of England and Wales is concentrated in town and city parishes, under many unfavourable conditions, and the annual mortality of Englishmen of the soldier's ages is 9 in 1,000.

The mortality of men of the same ages in the unhealthiest towns of England, and in the unhealthiest trades, is at the rate of 12 in 1,000.

Thus the mortality varies in different cases; and as it rises from 8 to 9 and 12, unfavourable sanitary conditions are discovered accounting for every degree of increase. The same principle holds in the mortality of the British army at home, which was at the rate of 17 per 1,000 annually, and is now declining in proportion as the causes of disease are abolished or mitigated.

The mortality of the non-commissioned officers and men serving in the British army abroad in the four years 1857-60 was at the rate of 41 in 1,000; of the officers the mortality was 30 in 1,000.†

The annual mortality of officers serving at home and abroad was 17, of non-commissioned officers and men 33

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* 7·7 per 1,000 is the exact proportion. See Tables by Dr. Farr in Appendix to Report on Sanitary Condition of the Army, p. 521, and Evidence, p. 12.

† Registrar-General's Report for 1860.

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in 1,000 during the years 1839-53, of European peace.* Sir Alexander Tulloch gave in his evidence a series of War Office returns of the strength, deaths, and mortality of the Royal army in India during 39 years, 1817-55, from which it appears that the mean strength in the three presidencies was 20,332, and the deaths 55,584, so the annual rate of mortality was 70 per 1,000. The Mahratta, Pindaree, Burmese, Afghan, Sinde, Sutlej, Punjab, and Chinese campaigns account, according to his estimate, for 10 of the 70 annual deaths.†

Those who are conversant with military statistics are well aware of the difficulty of obtaining results at once exact and precise. This difficulty is increased in India, and the necessary calculations are further complicated by the distribution of European officers among the native corps, by the mixing up of officers and men, or of the Royal army with that of the late Company, or of men at home in depôt with men in India, and by the confusion of invaliding from disease with the discharge of soldiers whose terms of service have expired. The medical returns for some time appear to have included only the deaths in hospitals.

After carefully examining all the documents at our disposal, we selected for analysis the nominal rolls of strength and casualties at the India House relating to the late Company's European troops. The collection of annual casualty rolls at the India House was "compiled "upon the principle of accounting for every man becom- "ing ineffective in the year." Verified by the signatures of the commanding officers and adjutants of corps, the rolls are perfectly intelligible and substantially correct; they have been, therefore, analysed elaborately for the purposes of this inquiry. The troops of the Company, unlike the Royal army, served only in India, where they remained until death, or until they returned home.

The deaths in the 57 years 1800–56 among all the Company's non-commissioned officers and men, including invalids in India, amounted to 40,420, out of an aggregate of 588,820 years of life, obtained by adding up the average annual strength in those years; so the annual rate of mortality has been 69 in 1,000 during the present century.

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* Appendix to Report on Sanitary Condition of Army, p. 521.

† See p. 319 of Evidence; and pp. 178–186 of Evidence before Commission of Inquiry into the Organization of the Indian Army, 1859.

MORTALITY OF BRITISH TROOPS.

The mortality rate was as high as 134 in 1804, in the first Mahratta war, and it was as low as 41 in 1852. It was high again in the years of mutiny, and it has been subsequently lower than the Indian standard. From the rate of 55 in 1770–99, the rate rose to 85 in the 30 years 1800–29; and the mortality fell to 58 in the 27 years 1830–56; so that the death-rate of the British soldier since the first occupation of the country down to the present day has oscillated round 69 per 1,000.

If the mortality is set down at 69 in 1,000, it follows that, besides deaths by natural causes, 61, or, taking the English standard, 60 head per 1,000 of our troops perish in India annually. It is at that expense that we have held dominion there for a century; a company out of every regiment has been sacrificed every 20 months. These companies fade away in the prime of life; leave few children; and have to be replaced, at great cost, by successive shiploads of recruits.

THE RATES OF MORTALITY AT DIFFERENT AGES IN INDIA.

MORTALITY AT DIFFERENT AGES.

To determine the rate of mortality among British troops in India, of different ages, as well as of different terms of service, the returns of the 10 years 1847–56 have been used. The mortality in the Bombay and Madras presidencies was much lower in those years than it had been previously; and the Table includes the non-effectives —invalids, pensioners, and men on the town major's list— at advanced ages. The mortality of war in India is, therefore, relatively unimportant; and we can appreciate the effects of the ordinary causes of mortality on men of all ages, from 10 to 75.

The mortality of boys, and of all under the age of 20, is much lower than it is ever afterwards; and other evidence shows that young men in favourable circumstances, and children with proper care, suffer less than adults in India.

See Table 11 [p. 178 *post*].

The mortality per 1,000 at the age of 20–25 is high (56·4); at the next age (25–30) it is less (48·8); and then it rises gradually to the age of 40; at the age of 40–45 the mortality is again higher (61·6) than it was at the earlier age of 20–25; the mortality afterwards falls.

It is worthy of remark, however, that the excess of mortality in India is nearly the same at all the seven quinquennial periods of age from 20 to 55, except at the first and the fifth, when the recruits join and leave their

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corps in greatest numbers. This points to the influence of the term of service, which we have also investigated, and seems to justify the inference that the fatal causes in operation produce nearly the same fatal results in India at all the ages, from 20 to 55, among men exposed to the same extent to their influences.

From the age of 55 the excess grows less, and at 70 and upwards the old men die nearly at the same rate in India as in England. Although the facts at the extreme ages are few, it is evident that the men of the middle ages are, under present circumstances, the greatest sufferers.

Tables 12 and 22–25 [p. 190 *post*].

From the rates of mortality we have had a life table constructed, and the mean duration of life, as well as the value of annuities dependent on soldiers' lives in India, can be deduced. These mortality and actuarial tables have been prepared by Dr. Farr.

Table 22.

The mean after-lifetime, or, as it is sometimes called, the expectation of life at the age of 20, is 17·7 years in India, 39·5 years in England; so life is shortened by 21·8 years.

Table 25.

An annuity is at the age of 20 worth 12 years' purchase on a soldier's life in India, or less by 10 years than an annuity on an average life at home.

What is the effect of residence in India on the after-lifetime of men who return to England at the age of 40? We have the means of determining this effect by comparing the after-lifetime of the Indian Table with that of the pensioners who have served in India.*

The after-lifetime at the age of 40 is 15 years by the Indian Table, 22 years by the Table of Indian pensioners resident for the greater part in England, and 26 years by the English Life Table.

INFLUENCE OF TERM OF RESIDENCE IN INDIA ON THE RATES OF MORTALITY.

INFLUENCE OF RESIDENCE ON MORTALITY.

This involves the important question of acclimation. In the Table 4 the facts for 1847–56 are arranged with reference to the soldiers' years of service; and it is evident

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* The Life Table for the Indian pensioners has been deduced from the facts supplied by Mr. Robinson in the Appendix to a War Office Report. The great irregularities observable in the probabilities of living a year, as given by Mr. Robinson, are evidently accidental, and are partly referrible to the state of the pensioner when he is placed on the list. The Table is, therefore, graduated by the method of differences applied to the logarithms, so as to give a uniform series.

INFLUENCE OF RESIDENCE ON MORTALITY.

Table 4 [p. 175*post*].

that the mortality (65·2) during the first year of residence is higher than it is subsequently. It decreases gradually, and becomes sensibly less in the fifth year, 44·1; it then rises slowly, and is 47·0 at the second quinquenniad (5–10); 52·8 at the third. The reduced number, 43·0, at the fourth period of residence (15–20 years) arises probably from the elimination of the sickly by invaliding, which then becomes active (6 per 100). This, however, although it takes away a fourth of the numbers annually, does not prevent the mortality, partly from advancing age, rising to 62·5 per 1,000 in the last periods of service.

It is evident that when men are exposed to the operation of very unhealthy places, many of the weak are cut off at once; while of the survivors some are exceptionally left capable of resisting the local poison, and others are so enfeebled by its influence that they rapidly succumb. These two sets of causes in conflict are nearly in equilibrium in India, so that the mortality always remains high; and if acclimation in the ordinary sense takes place, it is at advanced ages. The causes which destroy Englishmen in India, like arsenic or any other poison, do their fatal work in every year of age and of residence; and indeed the zymotic agents which produce cholera, dysentery, liver disease, diarrhœa, and fever in all its forms comport themselves like organic poisons.

No. 17, p. 539.

This view is confirmed by a new combination, in which a Table shows the mortality in different years of service among those entering India early and late in life. But, upon the whole, early entry into India appears to be an advantage not only at first, but in after-life.

Tables 1 to 39, pp. 531–575

It is further evident, from a comparison of the mortality in the several corps and presidencies, that the mortality in India depends on the intensity of zymotic poisons, and the time at which the men are exposed to the influences rather than on the incident that they have resided one, two, ten, or more years in the climate of the tropics.

LIVES WASTED IN INDIA IN EACH YEAR OF SERVICE.

LIVES WASTED IN EACH YEAR.

It is possible to exaggerate the waste of life in India, and this has sometimes been done by assuming that the reduction in the numbers is due to the deaths alone in such cases as the following: "Of the troops which Sir "Abraham Shipman brought with him to Bombay in 1662, "there remained in 1664 only 93 out of 500." "At the "time of Major Kilpatrick's death, in 1757, only 5 of the

LIVES WASTED IN EACH YEAR.

Evidence, Addendum, 3900.

"250 soldiers who accompanied him from Madras in "August of the previous year survived him."* A return handed in by Brigadier-General Russell throws some light on the reductions. Out of the 1,064 non-commissioned officers and men of his regiment (the 84th) who landed at Moulmein in 1842, only 93 landed in England on its return in 1859; thus the numbers were reduced from 1,064 to 93 in the 17 years, and the regiment was almost completely renewed in India. It was joined by 1,248 recruits, and the deaths were 817. Now had the mortality been uniformly 5 per cent. per annum (and the witness said it had been 3 per cent. for 14 years prior to 1857), the original numbers would only have been reduced in this case, by death, to 455. There are, besides death, many casualties which reduce the corps in India, and we shall shortly advert to them.

Again, the author of the useful book on the "Vital "Statistics of the Anglo-Indian Armies," "demonstrates" that the European army in India has hitherto disappeared in about 13½ years. This follows, he infers, from the fact that the mortality and invaliding are at the rate of 7·4 per cent., while in reality 1,000 men would only be reduced, at that rate, to 368 in 13½ years.†

We have the means of determining from the returns of the 10 years the casualties by death, by invaliding, and by other causes, in the late Company's European troops; and the results are shown in the Tables 5 and 6. The Table 6 has been constructed from the facts in Table 5 by the

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* Moore, Health in the Tropics, pp. 50, 51.

† This calculation has been adopted by other writers, and its fallacy is not immediately obvious. But assuming that the rate remains uniform, and is such that out of every 100 alive at the beginning of a year, 10 will die, &c., in its course, then the numbers will be reduced to 90 at the beginning of the next year; and, if the rate remain the same, nine, that is 10 per cent. of 90, will die in the second year; but upon the hypothesis of Dr. Ewart 10 will die every year until the 100 have expired; that is, 10 out of 90 will die in the second year, 10 out of 80 in the third year, and so on until, in the tenth year, 10 die out of 10 living, that is, the deaths, instead of being uniformly 10 per cent. on the strength, will be made by this procedure at last 100 per cent., which is contrary to the hypothesis of a uniform rate. Let n be any number living at any moment, and p be the fractional proportion living a year, then $np^x =$ the numbers surviving at the end of x years on the hypothesis of a uniform rate. In the above case $n = 100$ and $np^x = 100 \times (\cdot 9)^{10} = 35$ nearly. This accidental oversight must not deprive Dr. Ewart of the credit due to him for his useful work; which has been compiled with care. (See Digest of Vital Statistics, by Dr. Ewart, p. 20.)

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same methods as are employed in constructing life tables, for there is no simpler method of obtaining accurate results.

Table 6 [p. 176*post*].

It will be observed that 100,000 men are reduced to 9,604 in 20 years of service, by 90,396 casualties of every kind; 40,447 by deaths in the service, 14,627 by invaliding, 3,558 by purchasing their discharge, 8,972 by the expiration of their terms of service, 968 by promotion, 5,724 by transfers to the town major's list, 13,976 by transfers to other corps, 1,818 by desertion, and 306 by other causes. The half of the deaths (21,499) takes place in the first five years; and the numbers invalided increase slightly in each quinquennial period.

[p. 176*post*].

The decrement, year by year, of the force in India is shown in the annexed Table 7, in which it will be seen that 1,000 effectives are reduced to 96 in 20 years. Now, the 1,064 men of the 84th were reduced to 93 in 17 years; and this, while it agrees very closely with the tabular results, points to the fact that the Queen's regiments are reduced more rapidly than the Company's by the shorter terms for which the men enlist.

The mean term of service in India, immediately deduced from this Table, is 8·6 years,* and 11 recruits are required annually to every 100 men.† To maintain an army of 85,856 men, 10,000 annual recruits are required, even where the term of service is as prolonged as it was under the late Company's regulations. The recruits entering are reduced to less than half their original number in eight years; their probable term of service was, therefore, between seven and eight years.

The half of a regular army so constituted consists of men who have served less than six years, and not more than a fourth of the men are veterans of 10 years' standing, on whom the discipline and solidity of an army greatly depend.

It is evident that the recruiting is more difficult, and that the losses from other causes than death are greater in an unhealthy than in a healthy army, for the invaliding, the desertion, and the discharges from all causes are influenced by sickness.

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* The sum of the col. (l_x) $- \frac{l_o + l_{20}}{2}$ divided by l_o = the average term of service among the effective non commissioned officers and rank and file serving for 20 years or less.

† The number of annual recruits is obtained by dividing the strength by the average number of years' service.

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Tables 8 & 9 [p. 177 *post*].

We have constructed two other Tables, the one showing how the same number of recruits (100,000) would be reduced year after year by death alone, and the other showing the reductions by death and invaliding together.

By death alone 1,000 would be reduced in 20 years to 344; by death and invaliding to 216; by death, invaliding, and other causes, as we have seen, to 96.

Out of 1,000, by the Table 9, it appears that, if none were discharged except by death, 656 out of 1,000 would die in 20 years; while by Table 6 it appears that out of the 1,000, only 404 die in the service; hence it follows that if the same rate of mortality rules out as rules in, 252 of the discharged will die in the 20 years out of the service.

Diagram [p. 7 *ante*].

The waste of life in India is illustrated in the diagram, where it is contrasted with the decrement of life at home.

NATURE OF FATAL DISEASES AND ATTACKS OF SICKNESS IN INDIA.

NATURE OF DISEASES.

The great endemic diseases of India, those which injure the health or destroy the life of the British soldier, are fevers, dysenteries, diseases of the liver, and epidemic cholera, which has for many years engrafted itself on the endemics of the country. Compared with these all other diseases are of minor extent and importance.

The four diseases here mentioned are almost exclusively diseases of the sultry plains of India, and when any of them are found in the elevated lands they are generally modified in degree and reduced in proportionate frequency, certain forms of bowel complaints, when the sufferers are removed from the plains to the high grounds, being the only exceptions. We shall notice briefly each of these diseases.

Fevers.—Sir Ranald Martin states that remittent fevers are found almost everywhere throughout the East Indies, varying in their intensity and in their complications according as they occur in deltas, along marshy banks, or at the embouchures of rivers in plains extending from the bases of mountain ranges, termed "Terrais," in partially inundated or irrigated lands, or in tracts traversed by percolating streams, or occupied by jungles, or in certain low hilly districts. The seaboard, especially where there is jungle or salt marsh, and the adjacent islands when of a jungly or marshy nature are peculiarly pestilential, and so are often drying-up marshes and drying-up beds of rivers.

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Of the various obstacles which bar the colonization of the white man in tropical regions, and of the many causes which reduce the strength of our armies there, remittent fever is the principal.

Sir R. Martin states that out of a British force of 25,431 men serving for eight and ten years respectively in Calcutta, Chinsurah, and Berhampore, all in Bengal Proper, there occurred 13,596 cases of fever; that in the healthier upper provinces of the same Presidency with diseases generally of less degrees of severity, out of an average British force of 23,731 men serving there during seven years, there occurred 14,159 cases of fever, and that throughout India, 50 per cent. of all the admissions into hospitals are from fevers, while in the Presidency of Bombay, amongst persons of all classes, castes, and countries, fever causes about 40 per cent. of the total deaths.

But besides the great prevalence, personal suffering, and immediate risk to the life of the soldier under fever, the disease entails more or less disposition to relapses, with more or less after danger, according as the original fever may have been more or less malignant in its nature. Added to these circumstances again, it is found that diseases of important organs, the consequences of malarious fevers, occasion much of the subsequent sickness, mortality, and invaliding among British troops serving in India.

Dysentery and Diarrhœa.—Next to fevers in frequency, but more fatal, comes the dysentery of India. In its causes it is intimately associated with tropical fevers, remittent and intermittent; so much so that where fevers are present dysentery is never far off. "Dysentery," says Sir Ranald Martin, "has occasionally been found to "assume a malignant character in low damp situations, "so as to prove very deadly; but on removal of the "sufferers to elevated sites and a better air, the disease "has been rendered amenable to treatment."

He describes the dysentery of India as most prevalent in the plains and during the hot and rainy seasons. "Out of an aggregate British force of 25,433 men of "Her Majesty's army serving in periods of eight and "ten years respectively in the stations of Calcutta, "Chinsurah, and Berhampore, all in Bengal Proper, there "occurred 8,499 cases of dysentery and diarrhœa. The "climate of Lower Bengal has always been very un-

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" favourable to European health as compared to Upper " India; but, making allowance for all circumstances, " including the ill habits of life of the soldiery, the amount " of sickness from dysentery and diarrhœa here exhibited " is enormous." " In the presidency of Madras, again, " out of an aggregate British force of 82,342 men serving " there from 1842 to 1848, there occurred 10,531 cases of " dysentery and 9,189 cases of diarrhœa, making a total " of 19,720 cases of bowel disease, exclusive of cholera. " It thus appears that next to the malarious fevers of " India, bowel complaints are the most prevalent, while " the dangers to health and to life from these last are " even greater than from fevers." Sir R. Martin further states that amongst British soldiers 11 cases of dysentery occur to 1 amongst the native soldiery. In acute dysentery, as in malarious fevers, there is much present danger and suffering, and when the disease is not arrested at once, chronic suffering extending over years, or the prospect of death more or less distant in the hospitals, is all that remains to the soldier. The case is described by the older army surgeons as presenting " a spectacle of distress of as " pitiable a kind as can be found in the history of human " suffering." Invaliding and death are the last events, and most of the casualties which occur amongst sick soldiers on the voyage homewards from India are from chronic dysentery.

Diseases of the Liver.—Sir Ranald Martin states that, whether as original or secondary affections, diseases of the liver are a very frequent and very important class of diseases in the East Indies. He adds that no official returns, under special heads, afford accurate information as to the actual frequency of liver diseases; for when these last occur as complications with, or as consequences of, fever, dysentery, diarrhœa, or cholera, the cases are generally classed and numbered under the head of the primary disease. " It thus happens," he says, " that the " numerical hospital returns do not yield anything like an " approximation to a true estimate of the existing amount " of hepatic diseases." " Acute inflammation of the liver," he states, " is essentially a disease of the hot plains; and " its severity may be judged of by the fact that the " chance of death is greater from one such attack than " from 13 of fever of the various forms, as they ordinarily " occur in India."

In acute disease of the liver the danger to life is so

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imminent that the case must, within a few days, terminate in a recovery more or less complete, or in death; while the chronic form of this malady, the injury to health, and the protracted distresses are very great.

He further states, that out of an aggregate British force of 211,993 men serving in Bengal from 1812 to 1832, there were 14,015 admissions into hospital on account of diseases of the liver, of which 924 died. From 1833 to 1854, out of an aggregate force of 331,775 men serving in the same presidency, there were 18,765 admissions and 1345 deaths from liver diseases.

Epidemic Cholera.—Epidemic cholera is the most acute of all acute diseases, and, like the last mentioned, it always ends in the more or less immediate recovery, or in the death of the sufferer.

This disease has been known to prevail as an occasional epidemic at different years, seasons, and places throughout India from 1774 to 1817; and there are authentic records of its existence in Batavia so far back as 1629. The symptoms described at the different times and places leave no doubt as to the sameness of nature of the disease, not to mention its uniform and great mortality.

But in India, since 1817, cholera has engrafted itself on the endemics of the soil, and has become a disease of annual recurrence at many of our large stations, commencing generally at the beginning of the hot season, but sometimes in the rainy and cold season. It has proved everywhere, all over the world, the same disease, with the same mortality whenever it has fastened on a congenial soil; and its great tendency is to attack populations living in low, damp, crowded, and ill ventilated situations, especially if supplied with impure water; while the proportionate mortality amongst those attacked has been about the same, whether at the lowest levels or on the loftiest mountains.

Here, however, there exists an important distinction, that while the proportionate mortality of those attacked is everywhere the same, the proportionate numbers seized in high and low situations differ most widely. Cholera and epidemic diseases in general are of rare occurrence in the elevated ranges of India, where the water is comparatively pure.

Troops, both European and native, while on the march, have been observed to become more liable to seizure by this disease, and when the attacks have occurred in

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cantonments after the march, it has been found that the virulence of the epidemic has been proportionate to the length of the march.

As regards the comparative mortality Sir Ranald Martin states that out of every 100 deaths of Europeans serving in the Presidency of Bombay, between 1830 and 1846, the proportions of deaths attributable to the four great endemic diseases were as follows :—

Fevers - - - -	23·054
Dysentery and Diarrhœa - -	32·441
Diseases of the Liver - -	9·597
Cholera - - - -	10·320

Vide Miscellaneous Tables, with illustrative diagrams, p. 576.

We have the means of comparing the deaths of soldiers from each disease in the Bengal presidency with the deaths of men from the same disease at home. The periods are for the 16 years (1830–45) in Bengal; and for the seven years (1848–54), including the two years when cholera was epidemic in England. The annual rate of mortality was 10 per 1,000 in England, and 67 per 1,000 in Bengal, of which 58 per 1,000 was by zymotic diseases. The fevers, ague, remittent and continued, killed 17 men in 1,000; dysentery and liver disease, 20; cholera and diarrhœa, 18. Delirium tremens, catarrh, syphilis, rheumatism, and scurvy were also much more fatal in India than in England. Among constitutional diseases, the deaths from phthisis, scrofula, and cancer were fewer in Bengal than in England; but these cases are of long duration, and are precisely such as are sent home on the invalid lists to die.

Of diseases affecting particular organs, apoplexy is the most fatal, and 3 deaths per 1,000 are referred to that disease, which at the age of the soldier is exceedingly rare in England. The frequent pneumonias are, probably, of a congestive character, or are like bronchitis, connected with influenza. Enteritis, phlegmon, ulcer, ileus, jaundice, and spleen diseases are either masked zymotic diseases, or their common sequels.

The deaths from wounds are most numerous in India, but these deaths and all the deaths by violence in the return are less (·8) than 1 in 1,000, and less than the deaths by violence among the civil population of England (1·0). The medical returns under the old arrangements included only the deaths in hospital, and they did not include the killed in the field, which should be added. The two series of facts in the Table are strictly com-

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parable, and show clearly enough how much of the mortality of India is due to a few diseases, which are rendered fatal by well-known causes.

No. 1, p. 576, and diagram.

The fatality of these diseases to our armies in India is rendered evident to the eye in the two diagrams.

It is worthy of remark that nearly all these diseases fatal in India are accompanied by profuse discharges, with which the air, water, bedding, linen, closets, walls of hospitals and barracks become more or less infected. In a common building the *materies morbi* comes into contact with all the inmates.

In comparing the proportion of attacks of illness among British troops in India with that among men at home, we find that the East India Company formerly employed 2,461 labourers in London, and during the 10 years that observations were taken by the medical officer, 246 in 1,000 were attacked by illness annually; or each man was liable to one attack of illness of some severity every *four* years. This agrees with other observations, and includes cases of sickness of such gravity as disables artizans from following their ordinary work. In a Liverpool society, out of 1,000 members, 320 applied 400 times in the year for sick pay, and were treated by the surgeons, who also attended 350 more for slighter ailments, making 750 annual attacks of sickness, such as doctors attend to, among 1,000 members.*

Syphilis is not included in the returns of the friendly societies.

One thousand British soldiers at home experience about 1,000 attacks of sickness in the year, but in India the soldier's sickness is doubled. To one illness of the labourer, the soldier is liable to four, of at least equal severity. Thus, from a return supplied by Dr. Balfour, it appears that the 16,850 troops of the line in Bengal furnished the hospitals with 172,388 cases in the five years 1850–4, when 4,461 cases terminated fatally. A battalion of 1,000 men sent yearly on an average 2,045 cases to the hospitals; each soldier in India was exposed, therefore, to two attacks of illness in the year, instead of one. At Peshawur, during the same period, the admissions into

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* See article "Vital Statistics" in McCulloch's Statistics of the British Empire, vol. 2, p. 589. According to Mr. Neison the number of members sick during each year at the soldiers' age is 220 per 1,000 in friendly societies. Contributions to Vital Statistics, p. 160.

NATURE OF DISEASES.

hospital were 3,635 annually to 1,000 men, and in the hill stations of Kussowlie, Subathoo, and Dugshai, the admissions into hospital were at the rate of 1,783 per 1,000. The returns which Sir Alexander Tulloch gave in show that the attacks of sickness ranged from 988 to 3,225 per 1,000 men at different stations. 5563.

The attacks of sickness were sometimes slight; but in a large number of cases they were severe, painful, and fatal. Of the cases in the Bengal presidency before referred to, 75,535 were fevers, and 32,771 were diseases of the stomach, liver, and bowels, of which 2,517 were fatal. Add the 918 deaths by fevers, and the aggregate of 3,435 deaths leaves 1,021 referrible to other diseases.

LIFE-LOSS AND SICKNESS IN WAR.

LIFE-LOSS IN WAR.

5563. The mortality of the army from disease in India has always hitherto been raised by war. This is evident upon inspection either of the mortality among the Company's troops, or the Queen's. The Company's European troops died at the rate of 85, 134, and 101 per 1,000 in 1803–4–5; the period of the Mahratta war.* In the wars of the Marquis of Hastings, the mortality of the troops rose to 90 and to 117 per 1,000; in six of the years 1813–21, the annual mortality exceeded 90 per 1,000. In the Burmese war of Lord Amherst, the mortality of the Europeans was at the rate of 113, 106, and 130, in the three years 1824–6. Since that the Company's forces have been healthier in war; in the Afghan and Sikh campaigns their mortality has not exceeded 70, 80, or 84 per 1,000. The whole army is rarely engaged; consequently the effects of a war are partial, and fall upon particular regiments. Thus in the year 1845 the mortality of the Queen's troops was at the rate of 199 per 1,000 in Bengal, but did not exceed 46 in Madras, and 71 in Bombay. The Queen's troops in 1840–8, out of a force varying from 8,000 to 12,000 in Bengal, lost numbers ranging from 781 to 2,213 annually; and the mortality frequently exceeded 10 per cent. It is impos-

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* The troops had sometimes salt provisions and drank hard. Such passages as the following meet the eye in the Wellington Despatches:—"Urge the gentlemen there to send forward 3,000 or 4,000 gallons of arrack. * * * Salt provisions will also be much required, as the Bombay sheep contractor had failed entirely."—Camp at Poona, 15th May 1803, vol. v. p. 576.

LIFE-LOSS IN WAR.

sible to read the losses of particular regiments in the war of the mutiny without being struck by the inextinguishable valour of the British soldier; but it was disease, and not the enemy that killed him. For out of 9,467 men dying among regiments in India prior to the mutiny, or sent out in 1857–8, only 586 were killed in action or died of wounds. All the evidence goes to show that the mortality in the wars of India is chiefly from the diseases before referred to; and that the diminution in the mortality of wars before the mutiny was due to improvements in the sanitary arrangements. The battles in Sinde and the Punjab were as fiercely contested as any in which English troops have ever engaged native forces. 5563.

INEFFICIENCY IN THE ARMY OF INDIA FROM SICKNESS.

INEFFICIENCY FROM SICKNESS.

Of 1,000 of the East India Company's labourers in London, 16 were constantly sick, on an average at the ages 20–30; and in the friendly societies of England the amount of disability among artizans is nearly the same at the same ages. At the next decenniad the proportion of constantly sick becomes 17 or 20 in 1,000.* It was calculated by Mr. Annesley, the author of a standard work on the diseases of India, that 100 sick out of the same number was a normal state in India! This important element has not hitherto been sufficiently attended to in the army statistics; † and as we have not the new returns, recently introduced, it is impossible to show how much of the inefficiency is caused by each disease. Several diseases, such as rheumatism, ophthalmia, and syphilis, which are rarely fatal, cause a great deal of inefficiency, of which the admissions into hospital furnish a very inadequate measure. On the other hand some fatal diseases, such as cholera and consumption, produce very different amounts of sickness; for a fatal case of consumption lasts two years, of cholera two days.

The Table shows that, on an average in the stations of Bengal, 84 men in a battalion of 1,000 were constantly

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* McCulloch's Statistics of British Empire, art. Vital Statistics, p. 582 and p. 587, and authorities there cited. See also Ratcliffe on Sickness of Members of Friendly Societies, 1862. The observations on the East India Company's labourers in London extended over the 10 years 1823 33.

† The new English system had not at that time been introduced in India.

INEFFICIENCY FROM SICKNESS.

in hospital.* We have not illustrated this by a diagram, but it is easy to conceive the facts; 1,000 men are at a station; 84 of their number are sick in the hospital, where 69 die annually.

With this amount of sickness, an army of 70,000 British in India has, so to speak, a vast hospital of 5,880 beds constantly full of sick, and loses yearly by death 4,830 men, or nearly five regiments.

COST OF THE BRITISH SOLDIER IN INDIA.

COST OF THE SOLDIER.

The military expenses of India for the year 1856–7 amounted to 13,322,859*l.*, including the home charges for recruits, transports, and ineffectives. Deducting 166,386*l.* for the local civil corps, 13,156,473*l.* remain.†

The European officers and men in India in 1856 were 45,104, to which should be added, perhaps, 9,021, in depôts at home or on their passage, making 54,125 in the pay of the Indian Government.‡

The financial accounts do not enable us to determine directly the cost of the European force, as the expenditure is mixed up with that of the native army. But an approximate estimate can be framed. The native non-commissioned officers and men in the year were 235,221. The ratio of the cost of the Europeans to that of natives may be set down as 289 to 100, or nearly as 3 to 1.§

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* Average annual strength, 18,285; number constantly sick, 1,542·25; annual admissions into hospital, 36,814; annual discharges and deaths, 36,767; annual deaths, 1,040. Sanitary Statistics, p. 589.

† Parl. Pap. (32), 18th Feb. 1861.

‡ On Sept. 3, 1858, the total strength of the [European] cavalry and infantry regiments in India was 81,971; but only 50,979 were fit for duty, 6,616 being sick, 11,555 on passage out, and 12,821 in the depôts at home. To 57,595 in India, including the sick, 24,376 were away; to 100 present 42 were absent. Colonel Wood says nothing about the numbers "on passage home," but in pronouncing the number on passage out large, says, that "when a force is stationed at a distance from home, there must always be a large number in transit *to and fro.*" The number absent at this period was unusually great, and instead of adding 42, we have added 20 per cent. to the numbers serving in India. The legitimate purposes of the depôt are recruiting and training in order to maintain the efficiency of the regiments in India. (Appendix to Report of Commission on Organization of the Indian Army, p. 24.)

§ In the Appendix to the Report on the Organization of the Indian Army (1859), p. 55, the cost (including rations, clothing, and other charges) of 1,067 non-commissioned officers and privates of an infantry regiment of Her Majesty's service is set down at 25,999 rupees 8 annas monthly; and the cost of 1,140 non-commissioned officers and men, Cost of the Soldier.

Consequently the cost of 235,221 native soldiers is equivalent to the cost of 81,349 European soldiers. This number, added to the 54,125 Europeans, makes the cost of the Indian army equivalent to the cost of 135,474 Europeans. But the total military expenses, 13,156,473*l.*, divided by 135,474, gives 97*l.* per man as the annual cost of the European force; or, taking only the Europeans serving in India (45,104), the whole force is reduced to 126,453, and the cost per man is 104*l.*

For our present purpose it may be assumed that 100*l.* a year on an average is expended on the European soldier serving in India; this cost including the cost of arms, recruiting, and retired allowances for officers and men.

Table 3, [p. 174 *post.*]

The finance accounts of the army are defective, and often delusive; but the various recent reports, and particularly the papers by Colonel Baker and Sir Alexander Tulloch, on the relative expense of the late Company's European troops, throw much light on the subject, which has also been discussed with impartiality and judgment by Mr. Hammick. We have appended a Table, compiled from his, giving the chief results; for the sanitary state of the army is intimately linked with the finances of India, and influences them to a large extent.

The frequent errors in estimating the cost of troops in India arises from the omission of important items; indeed Colonel Baker omits, in his Table, staff charges in India, and the cost of camp equipage, ammunition, arms, stores, punkahs, bedding, hospital attendants, medicines, and transport in India, which raise the cost of a regiment 1,000 strong to 100,000*l.*

The annual pay of infantry non-commissioned officers and privates is at the rate of 60*l.* 13*s.* 11*d.*, or nearly 61*l.* per man; (including clothing, victuals, barracks, and allowances); the cost of transport by sea, including officers, 7*l.* 1*s.* 5*d.*; of levy money, recruiting, and depôts, 4*l.* 14*s.* 4*d.*; and of pensions, 9*l.* 3*s.* 2*d.*, or in the aggregate, with the pay of officers, 81*l.* 12*s.* 8*d.*, which is raised to about 100*l.* by other expenses.

It will be observed that the charge for barracks and buildings is 13*l.* 3*s.* per man, so that the accommodation of ten men costs 131*l.* a year! This is a high rent; yet

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including 1,000 sepoys, of a native regiment at 9,606 rupees 14 annas monthly; the cost of the European is to that of the native soldier as 2·8915 to 1. The other charges not here brought into account are assumed to be in the same ratio.

COST OF THE SOLDIER.

Colonel Baker says he had in his late office of Secretary to the Government of India peculiar opportunities of knowing the cost of permanent barracks for European regiments on the enlarged scale lately introduced, and is satisfied that the annual amount will not be less than 15,000*l.* a regiment.* Sir Alexander Tulloch quotes a return, on the other hand, to show that the building of a barrack for a whole regiment 10 or 20 years ago cost only 22,213*l.*, which implies, he says, an annual expenditure of 2,200*l.* a year.

The value of a man who, with all his arms, costs the country 100*l.* a year, reckoned at only a few years' purchase, is considerable, and either the loss of his life, of his health, or of his efficiency, is not to be lightly regarded, especially as it occurs most frequently and inopportunely in the field, when his services are required.

PECUNIARY COST OF SICKNESS IN THE INDIAN ARMY.

COST OF SICKNESS.

It may be assumed, as the sick soldier is a serious incumbrance in warfare, that the 5,880 sick cost the country as much as 5,880 effectives; if there were no sick, the army might be reduced to that extent. And as it has been shown that the army expenditure is equivalent to 100*l.* per man, the cost of the sick at these rates is 588,000*l.* annually. Deduct 200,000*l.* for sickness, assumed to be inevitable, and 388,000*l.* remain.

MORTALITY AMONG OFFICERS OF THE INDIAN ARMY, THE CIVIL SERVANTS, RETIRED OFFICERS, AND PENSIONERS.

MORTALITY AMONG OFFICERS, &C.

The Royal army, out of 9,192 officers in the year 1860, lost all over the world 244 by death; and the mortality was at the rate of 27 in 1,000. The mortality of the 3,965 officers of the Royal army serving abroad was 30 in 1,000 during the four years 1857–60, including the period of the Indian mutiny. In 1861 the mortality of officers was 16 in 1,000.

We have no recent returns of the mortality of officers serving in India, but there is no reason to believe that the rate varied much before the mutiny; and there is ample data for the essential purposes of this inquiry.

The 20th volume of the Asiatic Researches contains the results of an inquiry respecting the law of mortality for

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* Appendix to Report of Commission on Organization of Indian Army, pp. 49, 50.

British India. The facts, procured by the Government, were arranged by the late Col. Henderson with clearness, and they may be used with confidence.

MORTALITY AMONG OFFICERS, &C.

The East India Company had on an average, during the 20 years 1814–33, serving in India 4,219 military officers,* among whom 3,194 deaths occurred; consequently the annual mortality was at the rate of 38 in 1,000. Several of these officers were in civil employ, and some were on leave of absence; but they were all exposed to the Indian influences. This was not the case with the 1,079 officers of the Royal army, a considerable number of whom were apparently at the depôts in England; so the deaths were 742, and the annual mortality was at the rate of 34 in 1,000. The annual loss of the 5,298 officers of both armies was 197. Now of men of their ages in England about 53 die annually; consequently 144 officers died every year in India in excess of the natural deaths. In the 20 years the deaths at the English rate would have amounted to 1,060; and as 3,936 officers died, the excess by violent and unnatural causes was 2,876. Of this number 122 were killed in the field or died of wounds; consequently, while the danger to which they were exposed on the field of battle was fatal to 122 officers, the dangers from disease were fatal to more than 20 times that number!

The diseases were undoubtedly of the same character, and were, in fact, the same as those which kill the soldier. And the number of sick officers probably bears the same proportion to the deaths as has been found to exist in the returns of non-commissioned officers and privates. So the number of sick officers in India and on leave of absence from ill health is considerable, but it is not returned; and, if it were, the loss from the inefficiency induced by disease would be only imperfectly represented by the numbers on the sick list and absent from the field.

The value of the lives of officers, and the irreparable consequences of their loss to their families, pointed out at an early period the necessity of extraordinary measures for the promotion of life insurance, and led to the esta-

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* Each officer, after 10 years' service, was entitled to absence from India for three years, and to further absence in case of sickness after or before that term. After 25 years' service, 22 in India, officers were entitled to retire on the full pay of their rank.

MORTALITY AMONG OFFICERS, &c.

blishment of the various funds under Government encouragement.

One of the disadvantages to the officer arising from the insalubrity of India is shown by the high premium which he has to pay for the insurance of his life. Thus, at the age of 30, the annual premium of the insurance office on a life in England is 2*l.* 4*s.* 10*d.*; on an officer's life in India it is 4*l.* to insure 100*l.*

The soldier's life is still more precarious, and, allowing 10 per cent. for expenses, by his life table he would have to pay 5*l.* 15*s.* 3*d.* to insure the same sum at death. To the same extent as the shortening of life increases the risk of insurance it diminishes the accumulation of capital.

It will be observed that while during a long series of years the mortality of the soldier in India was at the rate of 69,* the mortality of the officer during 20 years was at the rate of 38 in 1,000. And it appears to be a fair deduction from this comparison, that the 31 annual deaths in excess of 38 are due to other causes than the climate of India; to which officers as well as men are everywhere exposed. We may proceed a step further in this direction; for the civil servants living in the unhealthy and healthy districts alike died at the rate of 20 in 1,000.†

The mortality of the Bengal military officers of the Company was at the rate of 31, Bombay 39, and Madras 45, in 1,000. Of the officers of the Royal army in India, the mortality was 34 in Bengal, 33 in Bombay, and 36 in Madras.‡

The local disadvantages of Bengal were in those days in some way compensated; and the returns of the military funds of the several presidencies confirm this result.

In order to determine accurately the mortality of officers, it is necessary to take their ages into account, as their mortality varies with age in India as in England; thus it will be seen that the mortality is greater in the higher ranks of officers than in the subalterns.

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* During the 20 years 1814–33, for which the mortality of officers was 38, the mortality of the non-commissioned officers and men was 83 in 1,000. By taking the general rate 69, the case is understated.

† "In the civil service the per-centage of mortality for the last 40 *years* has been somewhat under 2 per cent. for the first 20 years of residence in India, a result far more favourable than that of the other services."—[Colonel Henderson, Asiatic Researches, vol. xx., p. 199.]

‡ Asiatic Researches, vol. xx., pp. 201–3.

MORTALITY AMONG OFFICERS, &c.

The mortality of officers of all ranks, deduced from the most authentic materials, is given below :—

Facts supplied by	Years.	Annual Deaths per 1,000.				
	Age -	20	25	30	35	40
Col. Henderson, (India) - -	1814–1833	29	33	35	39	40
Mr. G. Davies, (India) - -	1760–1839	27	28	31	33	37
Mr. Neison, (India) - -	1800–1847	24	25	28	29	30
Do.	1840–1847	25	32	34	31	36
Mr. S. Brown, Madras Military Fund.	1808–1857	33	32	30	27	30
Men in all England - - - - -		9	10	11	12	14
Men in healthy districts of England - -		7	8	8	9	10

The Table may be read thus: the mortality at the age 20 and under 25 was at the rate of 29 in 1,000 Indian officers, according to the return of 1814–33;* at the age of 40 and under 45 it was 40 in 1,000. The mortality varies in different times and places as its causes vary.

The rate of mortality in the whole of the civil service of Bengal was, according to the returns of Mr. H. T. Prinsep, at the rate of 21·0 at the age 20–25; 20·1 at the age 25–35; 28·7 at the age 35–45; and 41·1 at the age 45–55.† In the Bombay civil service the mortality ranged from 24 to 26 under the age of 50.‡ The experience of the Madras civil fund from 1760 to 1853 exhibits a still more favourable result. The mortality ranged at the

Table 16, [p. 185 *post.*]

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* See the annexed Tables 17, 18, 19 [pp. 188–9 *post*]. For other returns, see the Report of Messrs. Finlaison and Lewis on Bengal Military Fund, as well as Mr. Neison's Reply.

† Asiatic Researches, vol. xx., p. 230.

‡ See Report of Griffith Davies on Bombay Civil Fund, dated 20th February 1836. In the reports upon the Indian Fund (p. 375) the probability of dying is incorrectly called the "*rate of mortality*," so as to mislead the unwary reader. Thus, if on an average out of 100 men living at the beginning of a year there are ten deaths in the year following, the probability of dying is expressed by the fraction $\frac{10}{100}$, which is incorrectly called in the reports "the rate of mortality;" but the rate of mortality is $\frac{10}{95}$, for the numbers living at the end of the year are 90, and the years of life are 90 + 10 half years, which it may be assumed are lived by the 10 who died in the course of the year. For the general formula for passing from the probabilities of dying to the corresponding ratio of mortality, see Table 12 [p. 179 *post*].

ages of 20 to 45, from 14 to 18 in 1,000; and at these ages the authenticity of the Table is unshaken by criticism.*

To illustrate the extent to which the insalubrity of India affected civilians, officers, and soldiers in India, we take four armies, each consisting of 33,615 young men of the age of 19. The first army remaining in England experiences the ordinary rate of mortality, and loses 254 in the first year, 276 in the second, 281 in the third, and so on; it is reduced to 30,453 men of the age of 30 in 11 years. The second army loses also 254 men in the first year; and it then lands in India, where it loses 353, 412, 452 men, as it suffers from the diseases and dies at the rate of Madras civilians: it is reduced to 28,916 men in 11 years. The third army out of the same strength loses 254 in the first year, or at the age 19–20; it then lands in India, and experiences the same rates of mortality as the military officers, and loses 865, 840, 819, and so on in successive years until it is reduced to 24,610 in 11 years. The fourth army loses 254 in the first year; it then lands in India, and suffering from the diseases of the Company's soldiers, it loses 2,052 in the first year of its residence in India, 1,811 in the second, and so it is rapidly reduced by death to 19,617 in 11 years.

Table 14, [p. 183 *post.*]

If there is much to shock the mind in these contrasts, they do not lack elements of consolation, for the unnatural death of the English soldier is apparently not the inevitable result of the climate of India; to which officers and civilians are also exposed. But, while the soldiers live together in common bedrooms in barracks, the officers generally reside in separate bungalows, where they have the due arrangements for cleanliness; their food and drink are of superior quality; their contact with the sick in hospitals is limited to periodical inspections; when ill themselves they have the advantage of separate apartments, and obtain leave to resort to healthy places. The military and civil servants of the Company were entitled, after 10 years' residence in India, to three years' leave of absence with gratuitous pay; and this period, by illness and medical certificates, could be extended to five years, which counted as a part of the 25 years entitling them to retire on the full pay of their respective ranks. In the hope of attaining higher rank or higher pensions, or for other reasons, the period of service in India was often extended.

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* See Mr. Neison's Report on the Madras Civil Fund, dated 20th July 1855. The expectation of life is not higher by this Table at the age of 55 than it is by the Table for healthy English districts; but the discrepancy of its results with Mr. Neison's earlier table is by no means fatal to its authority.

MORTALITY AMONG OFFICERS, &c.

The married officers are healthier than the unmarried. The civil servants are distributed all over India, and are necessarily exposed not only to heat, but to the influence of malaria, and occasionally to casualties from bad water; but their dwellings are, it is believed, better placed than the bungalows and barracks of the army; they also enjoy the comforts of homes, are married, and are exposed to none of the accidents of warfare in the field. They are occupied, and their minds are often actively engaged in the discharge of their duties. They are not driven to drink or debauchery by *ennui*.

The civil servant and the military officer at the close of their career habitually return to England, where they encounter the cold vicissitudes of a climate in which they were born, but to which they have long been unaccustomed. The "old Indians" are divided into two classes. The veterans who, like Hastings and the Wellesleys, bring home their native vigour, tempered in the Indian fire; and those who are either shattered by fevers, dysentery, liver diseases, and apoplexies, or are actually suffering from their sequels. Sir Ranald Martin has described their condition, and has shown how it can be ameliorated.*

The returned officers experience a higher rate of mortality at all ages under 65 than the people of England; but their mortality is lower at all ages than the mortality of officers remaining in the military service. Looking at some of the results it is questionable, however, whether veterans would not enjoy better health in retirement in the healthiest parts of India than they enjoy in England.

See Table 16, [p. 185 *post.*]

The pensioners in England who have served in the East and West Indies die much more rapidly than officers; but this is probably due to the circumstances in which they are placed. And it is not an easy matter to throw off at home the habits of dram drinking which they have been taught in the tropics.

The retired civilians probably enjoy the same advantages over the military in England as they enjoy in India; for many of their eminent members, after having served for a certain time in India, attain advanced ages. Only one

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* Diseases of Tropical Climates, by Sir Ranald Martin.

MORTALITY AMONG OFFICERS, &c.

governor-general (Cornwallis) died at his post in India during 90 years; and although the careers of the last two terminated prematurely, the 14 eminent men who have held that high office since 1772, for periods varying from one to ten years,—or six years on an average,—filled their expected number of years by the English life table.

In a previous section it was shown that the mortality of the British troops had been at the rate of 69 in 1,000 for a long series of years; but at stations in every variety of the climate of India the mortality has not exceeded 20 or 30 in 1,000; the excess of deaths over 10 being due to a few diseases, are referrible to local causes, which were at one time equally fatal in their operation in England. In the present section the facts lead to similar results.

1. The mortality of the officers who were stationed with the British and native troops (regular and irregular) all over India was excessive, and involved great losses of life and property; but it was less by 31 in 1,000 than the mortality of the soldiers. It follows that the lives of nearly half the soldiers, in less unfavourable conditions, might for the future be saved.

2. The civil servants at the soldier's age did not die at a rate higher than 20 in 1,000; and as they are distributed all over the country, it follows that the climate of India is not necessarily fatal to any higher proportion. The excess is due to other causes.

3. The diseases of the India civil servants, from which they have a comparative immunity in England, are known to be the same as are fatal to the soldier.

MORTALITY AMONG NATIVE TROOPS AND NATIVE POPULATION.

MORTALITY OF NATIVES.

The Asiatic soldiers of the Company are called native troops in the returns, while the British are called Europeans. These are merely local designations, and, as such, the former term must be understood to mean that the troops are natives of India, but not always natives of the provinces in which they are stationed.* The natives of the upper provinces serve in Bengal Proper, which Colonel Henderson said is "so injurious to this class of *natives* "that, although only one-fourth of the troops are stationed

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* Assistant Surgeon E. Balfour, Jour. Stat. Soc., vol. viii., p. 199.

MORTALITY OF NATIVES.

" in Bengal, the deaths of that fourth are more than a " moiety of the whole mortality reported."*

The secretary of the Bengal medical board returns the mortality of the native corps at the several stations of the army where European troops are cantoned as 7·6, or less than 8 in 1,000;† but the rate was as high as 27·6 at the presidency station, 18·0 at Barrackpore, and 15·0 at Dum-Dum. At many stations the mortality of the sepoys was as low as 4 in 1,000; but, in addition, " many unrecorded " deaths occurred at their own homes, where bad cases " were allowed to proceed on medical certificate." The more recent returns have been drawn up from other sources; and a paper by Colonel Sykes gives the mortality of the native troops from the military returns in an authentic form for the 20 years 1825–44.‡

The mortality of the native troops of the three presidencies was at the rate of 18 in 1,000. At the same time 19 in 1,000 were invalided. The ages of the men range from 18 to 45; and their ascertained mortality is therefore about 8 in 1,000 higher than the mortality of England. It was 36 in 1,000 less than Colonel Sykes makes the mortality of the European troops (54) for the same years, when the Europeans also lost 29 in 1,000 by invaliding.

The ascertained mortality of the native troops was, in Bombay, 13; Bengal, 18; and Madras, 21 in 1,000; the invaliding having, however, been in very different proportions in the three presidencies, namely, 33 in Bombay, 15 in Bengal, and 20 in Madras. Invaliding is, unfortunately, a very vague term in the language of the army, for as it includes a variable proportion of the men annually discharged, the results are to be used with caution; and it is certain that many of the invalids carry away fatal diseases, so that the mortality of the native army was, probably, not less than 20 in 1,000. Of the mortality, the proportion by cholera was 2·8 in Bombay, 2·2 in Bengal, 5·8 in Madras.

Inspector-General Macpherson, of the Madras presidency, gives a return, from which it appears that the mortality of the native troops was at the rate of 18 in 1,000 during the 16 years from 1842 to 1858; and as 6 in the 1,000 were deaths from cholera, the mortality, if

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* Asiatic Researches, vol. xx., p. 192.

† Asiatic Researches, vol. xx., pp. 193, 209–10.

‡ Journal of Stat. Soc., vol. x., pp. 100–31.

MORTALITY OF NATIVES.

that disease could be extinguished, would be 12 in 1,000. The invaliding is not given. The mortality of the native troops, according to Inspector-General Pearse, during the 10 years (1847–57) was at the rate per 1,000 of 7 at Jaulnah, where the European mortality was 10; 8 at Bellary; 8 at Cannanore; 9 at Secunderabad; 10 at Bangalore; 11 at Madras; 16 at Trichinopoly; 17 at Singapore; 23 at Moulmein in the Pegu division; 29 at Labuan. In Sinde the Bombay native army died at the rate of 43 in 1,000 during the years 1842–4.* The mortality of the "native [Indian] troops" in the last China expedition was, in 1860, at the rate of 32 in 1,000; when the mortality of Europeans was 48, or, including invalids who died on the way home, 54. Applying a similar correction to the Indians, their mortality per 1,000 must have been about 36 in 1860, and 60 in the previous year, chiefly from the zymotic diseases.†

The Bombay army consisted before the mutiny of Hindoos to a large extent (75 per cent. of their number); and in Bengal the proportion in the infantry was higher (83 per cent.); while in Madras the proportion was lower (60 per cent.) In Bengal, too, the Hindoos were principally Brahmins and Rajpoots, while in Madras the lower castes predominated.‡

5780. The native troops are for the most part married; their pay exceeds the earnings of the rest of the population; and, except in Bengal, the wives live with their husbands in small huts, which are made with skill and little labour, of the bamboo and matting. The Brahmin of Bengal leaves his wife at home, but visits her hut periodically on furlough. A hut, Dr. Wallich supposes, does not cost above two rupees, and lasts for a few years. The men have their bedsteads outside, except in the rains, and generally sleep outside. The Hindostanee sepoy does not taste meat, fish, or spirits, but lives almost exclusively upon unleavened cakes of wheat flour, daily baked upon an iron dish, and washed down with water.|| Mahomedans and low-caste Hindoos, such as the Mahrattas, who are Sudras, consume animal food, ardent spirits, ganja (hemp water), and opium. A return from Madras for 1848 shows

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* Journal Stat. Soc., vol. x., p. 104.

† Army Medical Report, 1860, pp. 101–11.

‡ Journal Stat. Soc., vol. x.

|| Colonel Sykes' Stat. Jour., vol. x., p. 124. Other cereals are also used, as well as wheat.

that in that year the mortality of the Hindoos was at the rate of 12, when the mortality of the Mahomedans was 10 in 1,000.

MORTALITY OF NATIVES.

The attacks of sickness among the Indians were at the rate of 667 in 1,000 during the same period of 20 years; when the Europeans sent more than twice that proportion (1,590) to hospital.*

The numbers admitted into hospital give an imperfect idea of the sick-time from each cause; but the excess of mortality among the native troops is chiefly due to cholera, dysentery, and fevers,—the same diseases that are fatal to Europeans; and the disparity in the deaths by these diseases is not considerable. Thus, in the Madras presidency, when the mortality of the Europeans was 48·6, and of the native troops 16·1 per 1,000 from all causes, the mortality of the two classes from cholera was at the rates of 7·6 and 4·0, of fevers 5·6 and 3·5.† Far different were the mortalities from the other diseases; thus, among the two classes the mortality per 1,000 was 15·0 and 1·0 by dysentery, 5·6 and 0·1 by liver diseases, 1·7 and 0·2 by apoplexy, inflamed brain, and insanity. Three diseases, exceedingly prevalent, serve to show that the attacks of sickness also differ in the Europeans and natives; thus, taking 1,000 men of each class, and under the rheumatism of the army 102 cases of Europeans are recorded, 53 of natives; by ulcers and abscesses 74 Europeans, 42 natives suffered. But the Europeans sent cases of syphilis to hospital at the rate of 192, the natives at the rate of 23 in 1,000.‡

Table Nos. 7 and 8, p. 583.

In Bengal and the North-western provinces (1852–3) the admissions of native troops into hospital were at the rates of 1,181 per 1,000 of the strength, including 678 cases of fevers, 127 of dysentery, diarrhœa, and cholera, and 28 of syphilis. The mean number of natives sick in 1,000 at the beginning and end of the year was 30; 9 by

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* The old medical returns overstate the attacks of sickness, or the numbers "treated," by erroneously adding the remaining at the beginning of each year to the new cases admitted during the year. The numbers treated are approximately represented by the mean of the cases admitted and discharged in the year.

† Years 1827–38. Paper by a Committee of the Statistical Society on data furnished by Mr. Annesley, the President of the Madras Medical Board.—Journal Statistical Society, vol. iii., p. 127.

‡ See also Jour. Stat. Soc., vol. xiv., p. 129, where the same disparities are shown for the years 1842–6.

Mortality of Natives.

fever, 3 by bowel diseases, 3 by rheumatism, 2 by syphilis, 6 by abscess and ulcer, 2 by wounds and injuries.

The English troops of the Madras army in 1842–6 sent 189 cases per 1,000 annually to hospital for syphilis, while the native troops sent 31. Colonel Sykes says "*only* 31," and adds, "as might be expected from the "majority of the men having their families with them."

Further instances will be found in innumerable returns, which it is unnecessary to discuss, as it is evident that the mortality of the native Indian troops does not exceed 20 in 1,000, and that in many healthy stations it does not exceed 10 in 1,000. The excess over 10 is not inevitable, for it is referrible, as we shall afterwards show, to malaria, bad water, and bad sanitary arrangements. The army is besides always surrounded in India by a multitude of followers, among whom cholera and other epidemics often break out and infect the troops. The sepoy's pay does not exceed a third of the pay of the Englishman, but he has an instinctive horror of barracks, and retires from duty to the lines, where he finds his hut, into which not even the doctor dares to penetrate. The sepoy there is free; his hut is his home. There he enjoys quiet; he has often the society of his wife, and children. The sepoy, in a hut which costs two, or, it may be, four rupees, appears to live three times as securely as the English soldier in barracks, which cost 131 rupees per man annually.

The census and the registration of deaths have never been carried out effectively, so as to enable us to determine the mortality of the native population with certainty, even in the cities, except perhaps for Calcutta. Dr. Strong has shown that among the natives of all ages, the mortality was at the rate of 51 in 1,000; the Hindoos dying at the rate of 57, the Mussulmans at the rate of 35 in 1,000.* The mortality fluctuated in 11 years from 37 to 81; and winter, as in England, was the unhealthiest season. The mortality of the suburbs is unknown.

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* Stat. Journal, vol. viii., pp. 50 and 52. The population of Calcutta city in 1837 was 229,705, while the suburbs held 217,193. The city contained 144,893 males, 84,812 females, in this, as in some other respects, resembling St. Petersburgh. See also a Paper by Mr. Bedford, the civil assistant surgeon, on the Vital Statistics of Chittagong (Jour. Stat. Soc., vol. xv., p. 129), in which he estimates the mortality of that town at 27 in 1,000. See also Sir Ranald Martin's valuable Report on Calcutta.

MORTALITY OF NATIVES.

The mortality in Delhi, containing 119,860 inhabitants, was at the rate of 36 in 1,000 in 1833; and the mortality of males differed little from that of females. The palace of 20,000 people is not included. It is, as might be inferred from its situation, less unhealthy than Calcutta.*

The mortality of Indian cities is not higher apparently than that of the European cities in the same unhealthy conditions.

The native troops, it will be seen, experience a rate of mortality nearly the same as that of the civil servants, living also in homes, but born in England; and they suffer from nearly the same fatal diseases. But the sepoy's superiority in health over the English soldier has often hitherto been explained on the hypothesis, that his organization is especially adapted to the climate in which he was created! But it is found that the sepoy suffers when he leaves his home, whether quartered in Bombay or in Southern China; and when taken from his hut he is shut up in Indian prisons, in his own climate he dies at greatly increased rapidity,—84 in 1,000 in Lower Bengal during 10 years—and of some of the same fatal diseases as destroy the English soldier in Indian barracks.†

The famine fevers, which are periodically fatal in India, as they were formerly in England, can be mitigated by improvements in the systems of culture, storage, and intercommunication. The Asiatic cholera, which sprang into epidemic life in India, may, like the Pahli plague,‡ be arrested at its source.

Fevers, rheumatisms, diarrhœas, choleras, dysenteries, scabies, herpes, lepra, and ulcers, which now abound, and afflict so heavily the natives of India, may be diminished. But the task is undoubtedly difficult. It depends largely

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* Asiatic Researches, vol. xx., p. 191.

† "Last year, I am afraid," said Dr. Mouat, "the mortality has averaged 12 per cent. [120 in 1,000] "upon the average number who were in custody in Bengal."—Evidence, Qu. 5792. See Dr. Mouat's able Report on Indian Prisons, Stat. Journal, vol. xxv., pp. 175–218.

‡ The fever called Pahli plague is of a malarious, remittent type, becoming in its progress of the continued character, and manifestly infectious under the favourable conditions of privation, filth, crowding, and defective ventilation. The term plague was applied to this fever from the circumstance that it became typhous in its course, and that glandular swellings arose, as in true plague, in the groins, axillæ, and neck. It has been known in India from 1815 to 1820, in Kattywar, Cutch, and parts of Guzerat. In 1836 the same form of fever prevailed at Pahli in Marwar, whence the designation latterly given to it in India.

MORTALITY OF NATIVES.

on the general improvement of the people. Their superstitions stop the progress of vaccination;* the women derive little benefit from medical advice, as they are seldom willing to see the surgeons of the dispensaries, and the sanitary condition of their towns is utterly neglected.

Java, under the tropics, is increasing rapidly in population, and in certain districts the mortality of the natives does not exceed 17 in 1,000. There appears to be no reason why India should not make equally rapid progress in population and salubrity under English rule.†

MORTALITY AMONG EUROPEAN POPULATION: OFFICERS' WIVES AND CHILDREN; EURASIANS.

MORTALITY OF EUROPEAN POPULATION.

The English population in India, according to the returns of the several Governments, amounted to 125,945;‡ consisting of an army 84,083 strong, its wives and children, and people in civil life, including the civilians in the public service. Allowing for any defects in the returns, it is evident that, exclusive of the army, the population would not fill one English county town; and including the army, it would be less than the population of the London parish of Marylebone.

Table 29, [p. 196 *post.*]

Of the Royal army, the proportions married, it will be seen, vary at each age; 93 per cent. of all ages were unmarried men; of the Europeans of the late Company's regiments, 70 per cent. were unmarried; of the civil population, of the age of 20 and upwards, 50 per cent. were unmarried,—a large proportion as compared with the unmarried population of England.

A higher proportion of the officers than of the men in the Royal army is married.

The rate of mortality among the married soldiers and the unmarried has never been ascertained in either service; but Mr. Griffith Davies ascertained that the married

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* 23 in 100 deaths are by small-pox among the Hindoos of Calcutta. Jour. Stat. Soc., vol. viii., p. 54.

† The population of Java was 6,368,090 in 1824, and 9,542,045 in 1845. In a population of 40,688 in 188 villages, Mr. Crawford ascertained that the marriages were 514; the births, 1,691; and the deaths, 696. Stat. Journal, vol. xii., pp. 61, 69.

‡ The European officers and men of the army in India were 84,083, the civilians were 22,556, and the women were 19,306, at the census of 1861. The Registrar-General of England has kindly supplied us with the results of the last census, which was made at his instance in 1861. We are indebted to Major Graham and his department for much valuable aid in other respects.

MORTALITY OF EUROPEAN POPULATION.

officers in the Bengal Military Fund died at the rate of 27 in 1,000 annually, the unmarried at the rate of 38 in 1,000. The subject requires further investigation. This excess of 11 deaths annually is the more remarkable, as the unmarried officers are younger than the married. The married ensigns died at the rate of 16, the unmarried at the rate of 36 in 1,000 annually.* Here the life without a home in India is triply fatal.

The women and girls enumerated as "British-born subjects in India" amounted to 19,306, of whom 9,773 were 20 years of age and upwards, including 7,570 wives, 1,146 widows, and 1,001 unmarried women. 786 wives under the age of 20 make the number of wives of English origin, under the age of 45, to be 7,626, scattered all over British India.

The wives of several Indian officers, if invalids, go to England; but the numbers in India in the early periods is so great that the mortality of the wives of officers of the Indian army may be taken to represent the mortality of English women in India. At the ages from 20 to 40 the mortality of wives and of widows in the Madras Military Fund does not, according to Mr. Samuel Brown, exceed 14 in 1,000. They are exposed to many of the same unsanitary influences as the soldier and the officer. The mortality is not higher than it was in London during the last century. All the deaths over 10 in this class, as in the others which have been investigated, are by the diseases not only of India, but of all unhealthy places. They may be reduced by energy and action, as they are increased by inaction.

Young children are generally easily affected by the climate, and it is found that the mortality of English children in India is lower than the general mortality of children at home. It is higher than the rate of mortality which the children of the same classes experience in the healthiest districts; but it is lower than the rate of mortality which the children of England generally experience. As age advances, large numbers of the children are sent home at great expense; and in Lower Bengal it is well known that if they remain they become feeble, and suffer from impaired health.

The wife and children of the non-commissioned officer and soldier do not fare so well, as the provision for their

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* Journal of Stat. Soc., vol. viii., p. 54.

MORTALITY OF EUROPEAN POPULATION.

accommodation is inadequate. The women are exposed to great hardship; they die at the rate of 35 per 1,000, including women of English birth and Eurasians.[*] In the lower orphan school of Calcutta the mortality was double or treble the English rates;[†] but more favourable results are obtained at the Lawrence military asylum in the hills.

At the census 11,636 women above the age of 15, of English origin, including 8,356 wives, were enumerated, and 98,888 men. Hence a certain number of soldiers marry Indian wives. The sons and daughters of the two races, known as Eurasians, or East Indians, or half-castes, amount to considerable numbers. They exceeded the English in the city of Calcutta at the census of 1837; for while the English amounted to 3,138, the Eurasians were 4,746,[‡] or including those in the suburbs, 5,981. Mr. Tait and others have investigated the mortality from imperfect data; and we see no reason to justify the inference that the mixed race of Anglo-Indians is an exception to the rule, that the mortality of all the races in India bears a constant proportion to the variable sanitary conditions in which they live.

Having given an account of the mortality and diseases to which British troops in India have been exposed, we next proceed to state briefly a few facts regarding the mortality at the more important stations.

STATIONS IN THE DECCAN AND SOUTHERN INDIA.

STATIONS IN SOUTHERN INDIA.

The station of Trichinopoly is within the tropics,[§] in southern India, and is reckoned one of the hottest to which troops are exposed. The mean temperature of the latitude is 82°, according to Mr. Glaisher. The temperature of night is high, and of the day still higher in the shade; the sun being even in winter nearly vertical at midday. The mortality was at the rate per 1,000 of 44 for 19 years, of 31 for 11 years, and of 20 for the four last years (1850–3), for which we have returns. The strength of the 84th Regiment, stationed there, was 1,001; the mean number constantly sick was 62; and the annual admissions into hospital 1,533.

Table 120, p. 751.

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[*] Moore, Health in the Tropics, p. 55.

[†] See Tables in Sir Ranald Martin's work on Tropical Climates, from a paper by Mr. H. Prinsep.

[‡] Jour. Stat. Soc., vol. viii., p. 50.

[§] Lat. N. 10° 50′.

STATIONS IN SOUTHERN INDIA.

Upon turning to the diseases it will be noticed that 4,593 of the 6,202 admissions into hospital are from zymotic diseases, so that 1,148 are admitted annually from these affections, and 402 from all other causes. 41 of the 81 deaths were from zymotic maladies; six from common fever in the army sense, 24 from diarrhœa, dysentery, and cholera. Moreover 53 cases of *vermes* occurred.

Deduct the deaths from zymotic diseases, and the annual mortality of Trichinopoly is reduced to 10 in 1,000. Among the other deaths, eight are returned as apoplexy, and seven as hepatitis.

We now cross over the Ghauts and descend to Cannanore, low on the Malabar coast, where the rainfall is 140 inches, and the temperature is still tropical. The mortality of a mean force of 903 in the 10 years 1847–56, was at the rate of 21 in 1,000; or, deducting the deaths from zymotic disease, 11 in 1,000. Of 192 deaths in 10 years, 53 were by dysentery, and 25 by hepatitis.

Ascending the Cauvery from Trichinopoly into the Mysorean territory, instead of going on to Seringapatam, which has been abandoned on account of its unwholesomeness,* we turn northwards to Bangalore, far from the coast, and about 3,000 feet above the sea. The mortality of the 1,342 men at this station during the 10 years of the return was at the rate of 20 per 1,000 annually; and it was less in the last five years. The cavalry, strength 644, died at the rate of 17, the infantry at the rate of 24 per 1,000. Upon inspection it will be seen that cholera and dysentery and hepatitis were the chief fatal diseases, and if we exclude the zymotics, the mortality of the station from other diseases, including hepatitis, is less than 11 per 1,000.

Large numbers of European pensioners have resorted to Bangalore since the removal of the restrictions prohibiting permanent residence. They live on plots of ground in clean, comfortable cottages, and were enrolled during the mutiny. If they had grants of land for gardens they

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* The Duke of Wellington was not misled by this presumed unwholesomeness. His own regiment was uncommonly unhealthy there, but he writes :—"I apprehend, however, that Seringapatam is not really more unwholesome than Bangalore." "I apprehend that a great part of the sickness at Seringapatam is to be attributed to the nature of the buildings which the officers and the troops have occupied," &c.—Despatches, vol. i., pp. 352, 353.

Stations in Southern India.

might supply the troops with vegetables. The veterans, numbering with their families more than 1,100, have the prospect of enjoying, with good sanitary arrangements, as long a life in India as their companions who return to England.

Northwards, at Belgaum, lying east of the Ghauts, 986 men were stationed; the mortality was for six years at the rate of 19 deaths in 1,000 living, of which 11 were by zymotic diseases, chiefly dysentery. Belgaum was formerly part of the collectorate of Dharwar, where the culture of the New Orleans cotton has been successfully inaugurated; and it is probable that the mortality of Englishmen will, when the causes of dysentery are removed, be as low as in Europe. The mortality at this station was formerly at the rate of 28, and even 41 in 1,000.

The 10th Hussars and the 14th Dragoons were stationed at Kirkee, above Bombay, in the 10 years 1847–56, and their mortality was at the rate of 19 in 1,000, or, exclusive of zymotic diseases, cholera, dysentery, and fever, 7 in 1,000. The mortality from all causes subsequently to 1855 ranged from 6 to 15 in 1,000 at Kirkee.

At Poona, of which the town, filled by 80,000 inhabitants, is 3½ miles from Kirkee, the mean mortality was at the annual rate of 26 deaths per 1,000 living in ten years, but of this number 16 were by zymotic disease: fever, dysentery, and cholera prevailed in the first five years, when the mortality was at the rate of 34 in 1,000. During the last five years the mortality at the station among 1,127 men was at the rate of 16 in 1,000, including a certain number of deaths from dysentery, cholera, and hepatitis. During the years 1857–60 the mortality was at the rate of 11, 6, and 34 annually, cholera having been epidemic in the latter year.

Abstract of stational reports.

Across the Nerbudda by the way of Baroda to the desert, we find Deesa, which is on the river Bunnass, but is visited by the breath of the burning desert, so that though out of the tropics, its temperature is extreme. The mortality of 893 men was at the rate of 26 in 1,000 during 10 years, or 12 exclusive of the zymotic diseases. The excess on the mortality over 10 is chiefly referrible to cholera, dysentery, remittent fever, and hepatitis. By the decrease chiefly of those diseases, the mortality from all causes in the last five years of the ten was reduced to 20 in 1,000.

STATIONS IN THE VICINITY OF LARGE CITIES.

STATIONS NEAR CITIES.

India differs from the colonies in one essential particular; it is peopled by the inhabitants of villages, towns, and large cities, as well as by families engaged in agriculture. As we shall afterwards show, the cities are still undrained, the earth is saturated with organic matter, the water is contaminated, and other sanitary defects abound. In these cities, zymotic diseases are aggravated, and assume the same destructive forms as they did in London before it was drained, and was supplied with water free from enteric impurities.

Extract from Registrar-General's tables, [p. 186 *post.*]

The health of the English army is indissolubly associated with the health of the population of the country which it occupies; hence it will be found that the mortality of the troops is above 20 in 1,000 at all the stations of the great Indian cities. The numerous camp followers always connect the cantonments with the city, and they exist in a community of suffering, as well as of advantage.

Hyderabad, the capital of the Nizam's dominions, is on high land near the centre of the Deccan; it is surrounded by fine sites; but the barrack for the European regiments is in an unhealthy locality at Secunderabad. A regiment, of which the mean strength was 753, died at the rate of 64 in 1,000 annually;* in one year, a third of the force was killed; and the deaths in the 30 years (1804–33), chiefly by dysentery, were about 1,435. The barracks were emptied twice by deaths in 30 years; and the graveyard close above the barracks was filled; for a crowded barrack crowds the churchyard. New barracks were erected on the same site, and the mortality declining, still remained as high as 37 in 1,000 during the years 1837-58. In the last year of the period, 104 of the First Royals died out of a strength of 1,098.† The officers lived in detached bungalows, and their mortality rarely exceeded 20 per 1,000. 2381-2.

The mortality for eight years in the force at Fort St. George, Madras, was 35 in 1,000,‡ 18 being by zymotic

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* Report of Dr. Crawford in Army Medical Report for 1860, p. 320. It is here assumed that the annual deaths (63·76) which Dr. Crawford has given, express the rate of mortality per 1,000. If, as stated, those deaths occurred in a strength of 752·8, the mortality must have been at the rate of 85 in 1,000, and the total deaths in the 30 years 1,913.

† See the Evidence of Dr. Maclean, and the Report of Dr. Crawford, in the Army Medical Report for 1860, pp. 313–29.

‡ Strength, 825 for 8 years, 1847–54. *Vide* returns pp. 735, 750.

STATIONS NEAR CITIES.

diseases; and 81 were constantly sick. For the latter four years the mortality was less than it had been. For 34 years the mortality at Fort St. George was at the rate of 40 in 1,000 annually.

5565. In Bombay and Colaba a return of one year exhibits a mortality in a small force of 59 in 1,000; for 23 years the mortality was at the rate of 63 deaths annually to 1,000 of strength at these fatal stations.

The other stations of the Presidencies of Madras and Bombay have hitherto experienced intermediate rates of mortality for the years for which the stational returns are supplied; the rates of mortality per 1,000 were at Hyderabad, 36; Kamptee, 35; Kurrachee, in Sinde, 34.

STATIONS ON THE GANGES.

STATIONS ON THE GANGES.

The stations in the basin of the Ganges present some peculiarities. That river receives in a thousand streams the waters of the Himalayas, and of the Vindhyan range of hills, besides the abundant rains that flood the plains in the wet season. Moisture and heat produce luxuriant vegetation, which feeds millions of animals, and the plain is inhabited by millions of men. Perhaps no river in the world has on its banks so many populous cities, which are in constant communication through the water, the air, the boats, and the stream of traffic on the roads. The low ground is subject to inundations, and the flood, as the banks of the river are high, is left to evaporate after its subsidence.

There is, then, in the plain of the Ganges, danger from malaria of the undrained lands, besides the various dangers generated in the barracks, in the canteen, in the bazaar, and in the city.

The delta of the Ganges is a great epidemic centre, and there cholera first took the form in which it ravaged the world.

The capital of India is still undrained, uncleansed, and unsupplied with fresh water; so its diseases are as fatal as some of the diseases of London in former times. The main artery of the commerce of Asia, the Ganges, does the same work as the Thames; it also carries down 236 million cubic yards of soil annually; it floods the land, and besides ships, its tides waft up and down the unburnt and unburied dead of the Hindoo population.

Fort William, as might be anticipated, enjoys no sanitary immunities, for the mortality of the infantry during ten

STATIONS ON THE GANGES.

years, within its walls, was not at the rate of 20 or 10, but of 102 per 1,000 for ten years! For long periods the mortality is cited at 69 and 58 per 1,000. At Dum Dum the mortality was 77; and at Chinsurah, the old Dutch settlement, 54 and 70.

These stations, and Barrackpore, are on the delta of the Ganges, where the invalids embark and recruits are landed. The Rajmahal hills offer superior sites for troops; and at Hazareebaugh, only 1,900 feet above the sea, the mortality was, amidst many unfavourable circumstances, 57, and during two years 34 in 1,000.* Upon ascending the river and 212 feet above the sea, but on a dead level, we come to Dinapore, where the mortality was 63 in 1,000; at Ghazeepore, still further up the river, the mortality was 47 in one year. For twenty-two years, the mortality was 78 in Dinapore; for nineteen years 52 in Ghazeepore. At Allahabad the mortality is excessively high; at Cawnpore, it was 91 in 1,000 for seven years. For twenty-nine years the mortality was 66 in 1,000 at Cawnpore. For seven years at Agra, 800 feet above the sea, and 50 feet above the surrounding country, the mortality was at the rate of 42; for twenty years it was 48 in 1,000.

At Meerut, 800 feet above the sea, and 100 feet above the country on the Doab, between the Jumna and the Ganges, the mortality of the infantry per 1,000 (816 for 10 years) was 45, of which 31 was by zymotic disease. Dysentery, diarrhœa, and cholera prevailed; ophthalmia was epidemic; apoplexy, and hepatitis, and alcoholism, implying hard spirit-drinking, were also fatal to the infantry at this station, where the cavalry, lancers and dragoons, (630 for 6 years,) died at the much lower rate of 20 in 1,000, or, exclusive of zymotic disease, 8 per 1,000. The mortality of the large force (1,777) at Meerut in 1860 was 11 in 1,000.

The mortality of Meerut was at the rate of 32 per 1,000 for 19 years; so that the mortality (44) of the next fourteen years, and of the infantry in 1847–56 (chiefly the 29th, 32d, and 81st foot) must have been due to some accidental disturbance.

All the Bengal regiments enter India at the Calcutta stations;† and if through crowding, or any other cause,

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* In the year 1860 the mortality was at the rate of 27 in 1,000 (Army Medical Report for 1860, p. 114).

† Fort William, Dum Dum, Barrackpore, Chinsurah.

STATIONS ON THE GANGES.

they contract zymotic disease, it follows them; for a regiment carries its diseases with it. Thus the 29th regiment of foot arrived in India on July 29, 1842, and it was stationed at Chinsurah, where it lost 106 men before April 1, 1843. Proceeding to Ghazeepore, it lost 158 men, and 260 men respectively, in each of the next two years. Its valour was not extinguished by disease; for 141 of the men were killed, and died of their wounds in the Sutlej campaign, and 48 in the Punjab campaign. These terrific losses were, however, exceeded at Chinsurah and Ghazeepore, before it had seen the enemy. This was one of the regiments which brought discredit on Kussowlie. It lost 1,061 men by death in India before it embarked for England on September 30, 1859. Its mean rate of mortality during the seventeen years was 95, or exclusive of the killed and of those who died of wounds, 86 in 1,000.

So fearful are the consequences of zymotic diseases in a regiment entering India.

In reasoning about the mortality of the stations higher up the country, it is necessary to bear in mind that regiments sometimes carry some diseases with them and with their camp followers, from the stations below. Other illustrations of this principle will be found in the regimental returns, which though imperfect, are invaluable.

OUDE, THE CIS-SUTLEJ DISTRICT, AND THE PUNJAB.

OUDE, THE PUNJAB, &C.

Oude has been only occupied recently; but it is gratifying to find that in the year 1860* the mortality of the large force in some stations is not much higher than the standard: thus at Seetapore it was 18 per 1,000; Gondah, 20; Roy Bareilly, 23; Fyzabad, 32. At Lucknow the mortality was 27 in 1,000. The zymotic diseases and their obvious causes account for the excess over 10 in 1,000. The mortality of Allahabad and Cawnpore is reduced.

The stations of the Punjab were not always well selected, and they were necessarily, at first, in an unsettled state. The mortality was at the rate of 81 per 1,000 for infantry, 56 for cavalry, at Lahore; 80 per 1,000 for cavalry, and 56 for infantry in Ferozepore.

Upon leaving Delhi, the great road leads to Umballa, a large city on this side of the Sutlej, and thirty-five

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* Army Medical Report, 1860, p. 114.

OUDE, THE PUNJAB, &c.

miles from the Himalayas around Simla. The station is about three miles from the city, and 1,050 feet above the level of the sea. The mortality during ten years (1847–56) was at the rate of 55 per 1,000; but the cavalry (dragoons and lancers) died at the lower rate of 23. The infantry fell from cholera, dysentery, fever, intemperance, and its sequels sun-stroke, and hepatitis. The 75th foot was the principal sufferer.

Crossing the Sutlej into the Punjab, the mortality before 1856 was, at Jullundur, among infantry, at the rate of 37; at Sealkote, 27 among infantry, 13 among cavalry; at Rawul Pindi, 29. Excluding the zymotic diseases, which are sometimes due to removable causes, and often the result of causes to which the regiments were exposed elsewhere, the mortality of all these stations is reduced to 6, 12, 13, or 14 in 1,000. It is, therefore, not naturally higher than the standard.

In fact, the mortality in the year 1860 from all causes, was in Jullundur 7, Sealkote 13, Rawul Pindi 13, Umballa 15 per 1,000.

At the fortress station of Govindghur, near Umritsir, the holy city of the Sikhs, one death occurred in two years among a small force, where several, however, were attacked by ague.

The stations are at heights ranging from 900 to 1,500 feet above the sea level, and at some distance from the hill stations. The mortality at these elevations is not greater, therefore, than the mortality among British troops was formerly in England; and we feel justified in adding, after carefully weighing the facts, is susceptible of being reduced to the English rates, under ordinary circumstances. The Sikhs are a perfectly healthy, vigorous race.

The mortality in Peshawur was at the rate of 61 per 1,000 of the mean strength for eight years. Fevers, dysentery, apoplexy, and liver diseases abounded; and of a mean force of 1,674 men, 193 were constantly sick, down to the year 1856.

STATISTICAL RESULTS.

We sum up briefly the results of this portion of the inquiry as follows:—

1. The English troops in India, by the returns of 1861, consisted of 8,324 officers and 76,684 non-commissioned officers and men, making in the aggregate an army of 85,008 men. The annual expenditure on the army of India has been at the rate of 100*l.* a man.

STATISTICAL RESULTS.

2. The mortality of the officers in India has hitherto been at the rate of 38 per 1,000, which is 28 higher than the English rate of mortality. Of the sickness there are no returns, but it is, undoubtedly, as excessive as the mortality.

3. The mortality of the non-commissioned officers and men during a long series of years has fluctuated, and has been on an average at the rate of 69 in 1,000. The mortality of men in England at the soldier's age is at the rate of 9 in 1,000. 60 in every 1,000 men were killed annually in India by the causes there in operation; the numbers slain in battle being few compared with the deaths by fevers, dysentery, liver disease, and cholera. About 84 in 1,000 men were constantly inefficient and in hospital, from the sickness induced by thousands of attacks of disease, including a large proportion of venereal cases.

4. The excess which has hitherto been observed in the mortality of India is in every station due to nearly the same zymotic diseases. These diseases were for centuries equally fatal in the cities of Europe. In Europe they are also still prevalent under the same circumstances, and they are generally most fatal in the summer, when the sun is not so hot as in India, but is above the horizon a greater number of hours.

5. The experience of the civil service, of the military officers, of their wives and children, of the English troops in many stations, and of the native troops, proves that in the present state of India the mortality of the English troops there can be reduced to the rate of 20 in 1,000.

We have considered it necessary to enter into this lengthened analysis of the sickness and mortality affecting British troops serving in India, partly with the view of giving an authentic account of the facts with which we have to deal, but mainly to show the great importance of the subject to the public interests, and to enable us the more readily to ascertain to what extent this great sick and death rate can be diminished by known sanitary precautions. We next proceed to deal with this portion of our inquiry.

INFLUENCES AFFECTING THE HEALTH OF BRITISH TROOPS SERVING IN INDIA.

INFLUENCES ON HEALTH OF BRITISH TROOPS.

It will be seen, from what we have stated above, that out of the entire range of diseases to which European residents in India are subject, the diseases belonging to

INFLUENCES ON HEALTH OF BRITISH TROOPS.

one single class, the zymotic, occasion by far the largest amount of mortality and inefficiency among troops serving in that part of the empire. It may be stated, in round numbers, that, at many stations, from one-half to two-thirds, or even more, of the deaths, and upwards of three-fourths of the admissions into hospital proceed from this class of diseases.

If to these be added heat apoplexy, and liver complaints, frequently the consequence of certain forms of zymotic disease, we shall have included the main causes of premature and preventible mortality with which we have to deal.

Were it possible wholly to put an end to deaths arising from the various classes of fevers, from cholera, dysentery, and diarrhœa, together with hepatitis and its consequences, the troops serving in India would become as healthy as any body of men in the world.

The practical part of our sanitary inquiry, therefore, resolves itself into ascertaining the causes of these diseases, so far as it may be possible to do so, and determining to what extent we may reasonably hope to mitigate their virulence, if not to prevent their occurrence.

The problem is not peculiar to India. Zymotic diseases have always been the chief causes of mortality in uncivilized or imperfectly civilized countries, and they have been the special scourges of armies. If the vital statistics of all nations could be brought under review, they would testify to the fact that a great proportion of the ordinary every day mortality arises from some form of fever or bowel disease, increasing in severity during certain seasons and years; at times assuming the dimensions of pestilences known under the names of black death, plague, or cholera.

Whole regions of the earth which were formerly devastated by fever-pestilences, and dysenteries have long since been free from them, except in the milder forms in which they now occasion part of the ordinary mortality. England, which suffered, at various periods, as much as other countries, has shared in this exemption; and, guided by the light of experience, we see no reason why India should form any exception to the rule, that in proportion as the conditions of health become better known and complied with, these diseases, the *opprobria* of imperfect civilization, should diminish both in frequency and in malignity.*

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* *Vide* Note on the Diseases of London, [p. 186 *post.*]

INFLUENCES ON HEALTH OF BRITISH TROOPS.

Science has hitherto failed to discover the special cause of epidemic diseases. These diseases are observed to occur in very different degrees of intensity at different periods, amongst groups of population exposed to certain unhealthy conditions. Sometimes they take the form of pestilences, and immediately afterwards, the conditions remaining the same, they subside and all but disappear, again to renew their ravages at some future period.

The great difficulty of reducing their phenomena under any general law formerly led many persons to doubt the practicability of diminishing their prevalence; but a more rational mode of inquiry, pursued chiefly in this country, has led to the discovery, that, assuming the oscillation in intensity simply as a fact, there are certain well-defined conditions which influence most materially, not only their intensity, but also their frequency.

One of the earliest discovered of these facts was, that intermittent fever disappeared from places which it formerly ravaged after drainage of the soil and improved cultivation.

It was next discovered that by cleanliness, fresh air, and diminished crowding, the very worst forms of pestilential fever which used to commit ravages similar to those of plague, disappeared entirely from English gaols.

Fevers of the typhoid and continued class, and various forms of bowel diseases have been greatly diminished in frequency and severity by drainage, by improved domestic arrangements for removing human excreta safely and rapidly away from dwellings, by increased space and better ventilation.

Under improved drainage and other sanitary arrangements, fevers of the remittent type have almost ceased to exist in certain localities where they formerly prevailed.

Cholera and dysentery are now well known to depend mainly for their frequency and severity on the neglect of known sanitary precautions; and so intimately are these diseases connected with the condition of the water supply, that while an epidemic prevails, the question whether a given population shall suffer or escape may almost be predicated by a chemical analysis of the drinking water.

So far as the experience of more temperate climates can be admitted as evidence, it tends to prove that the very class of diseases, formerly so fatal in this country, and which has occasioned so very high a rate of mortality, both absolute and relative, among the Indian army, is, to a large extent, dependent on removable conditions and habits.

INFLUENCES ON HEALTH OF BRITISH TROOPS.

In pursuing our inquiry, we have received much evidence of great value and importance from witnesses practically conversant with the sanitary state of the troops in India, and we have besides endeavoured to obtain an accurate account of the sanitary state of every military station in India and its dependencies, by the printed questions already mentioned, addressed to commanding, medical, and engineering officers at each station.

We have included in this part of our inquiry local topography and climate; the sanitary condition of cantonments, barracks, hospitals, bazaars, and neighbouring native towns; the source, quality, amount, and means of distribution of water supply; the diet, drink, clothing, accoutrements, duties, and recreations of the soldier, together with the observed effect of all of these conditions on his health. From the replies received to our questions, and from reports of inspecting medical officers, we have been enabled to collect a large amount of most valuable data, which not only throw much light on the subjects of inquiry committed to us, but which, we believe, will be in other respects of great use to the public service.

In dealing with the evidence before us it is necessary to bear in mind that the soldier's health in India, as elsewhere, is the product of all the conditions to which he is exposed. It is not solely the result of climate, nor of locality and dwelling place, nor of diet, habits, nor duties; it is the product of all of these. Some of the conditions to which the soldier is exposed are irremovable, and some admit of being modified or removed. To what extent this can be effected is, indeed, the main practical object of our inquiry.

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India extends over 26 degrees of north latitude. It has a superficial area of 1,500,000 square miles, enclosed on the north, east, and west by gigantic mountain ranges for 4,500 miles, and along its southern, eastern, and western sides by 4,500 miles of tropical seaboard.

Much of the country consists of plains traversed by large rivers, having deltas projecting into the ocean, and hardly raised above its level. In other parts there are extensive table lands of greater or less elevation, rising from the plains below. Along the west coast there is a continuous range of mountains, intercepting the warm moist winds coming from the Indian Ocean, and influencing

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the climate for a considerable distance inland. Here and there are solitary mountain groups of varying altitudes, from 3,000 to 5,000 or more feet, presenting, from their elevation, very different climates from those of the plains within sight. The northern barrier of the Himalaya consists of a succession of ranges, increasing in height as they recede towards the north, until they attain altitudes of from three to five miles.

According to the popular notion, the mortality of the British in India is explained by the heat and strangeness of the climate. Hot climates are believed to be hostile to human life, and to be especially deadly to the English race. In the West Indies, on the Coast of Africa, and in India the forces have been at intervals decimated by epidemics, through the century that England has held possessions within the tropics, and the climate has always been blamed.

So much has been attributed to its influence in India, that we considered it necessary for our inquiry to place the documents at our disposal in the hands of Mr. Glaisher, who has for the first time given a comprehensive view of the geographical distribution of atmospheric phenomena over this vast and various peninsula.

India, according to Mr. Glaisher, enjoys in its temperature perpetual summer on the plains; it has there no frost or snow; the heat, however, is as excessive there in some months as the cold is in Europe in others: and rain is as abundant in the rainy season as it is frequent through the year in England. He shows that the observed elements of climate vary with the latitude, longitude, and elevation; that there is higher temperature and a much larger amount of dissolved water in the air than in England, although the relative amount of moisture to temperature is less in India. But as far as relates to the influence of moisture on health, the actual amount of dissolved water may be taken as indicating the amount of organic matter in the air, of which water is the solvent and vehicle; and hence, although the relative amount of water in the air in India is less than it is in England, the atmosphere considered in relation to the effect of humidity on health, is more humid than it is in England.

The sensible effects of climate in India vary as widely as the physical characters of the country. On the plains and deltas the climate is hot and moist with considerable rain-fall. In the southern parts of India there is heat and

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dryness. On the mountain ranges, the temperature falls with the elevation; and at certain altitudes diminution of heat is accompanied by a perceptibly moist condition of the air. Along the face of mountain ranges exposed to the monsoon, there is an excessive rain-fall, to be measured by feet rather than by inches, rendering the country almost uninhabitable for the time of its duration; while within a short distance to leeward, the atmosphere is dry and clear, with little rain. The climates of the seaboards vary with the direction of the wind. Sometimes they are comparatively cool, while at others they are warm, moist, and depressing. The climates of certain isolated mountain groups and table lands are almost as healthy as those of Southern Europe; while at the base of the same mountains there are local climates, which are absolutely pestilential.

At the majority of the stations occupied by British troops there is a high mean temperature, accompanied with much dissolved moisture. At many of them there is a considerable difference between the day and night temperature, accompanied by night and morning fogs, and by a feeling of coldness succeeding a high temperature during the day.

Heat, moisture, and variation between night and day temperature are the three special climatic conditions to which the soldier in India is exposed, and except in so far as the degree of humidity is the result of local defects in drainage, these conditions cannot be changed, unless by resorting to mountains or table lands as sites for military stations.

Such being the case, it is very important to consider—what amount and kind of influence these climates are likely to exercise on the soldier's health? In dealing with this important question we are struck with the absence of direct allegations against climate in the stational reports. Although most of these reports contain statements more or less specific as to the effect of particular seasons on the amount of disease, the reporters do not attribute the soldiers' mortality to the climate of the stations. Other causes are usually assigned. This negative evidence is of great importance as against the common opinion regarding the fatal character of Indian climates. It is nevertheless certain that climate does exercise some effect on the general health of persons exposed to its influence. Experience shows, first, that long-continued exposure to

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Indian climates gradually deteriorates the constitution; and, secondly, that diseases of the epidemic class prevail most severely and extensively in localities where, and at seasons when, the elements of heat and moisture most predominate. If careful inquiry were to show that there were absolutely no other agents at work in producing these results except high temperature, then we should be driven to the conclusion that nothing short of change of climate and station would preserve the health of the army. But, as we shall presently show, there are many other agencies at work besides those due to climate *per se:* and first among them we must place that subtle, unknown agent, or rather that cause of disease known only by its effects, malaria.

At all the stations of India from the Himalayas to Cape Comorin the presence of malaria can be traced by its influence on health. It is the chief cause of periodic fevers and certain forms of marasmus and spleen disease among the native population. It underlies the cause of many other diseases, and it appears to exercise a powerful influence on the course of epidemics of cholera. It is most intense in its operation in low, warm, moist localities where there is a superabundance of vegetation and water, and it also shows its presence in dry situations, where these conditions are apparently wanting. At considerable elevations, where the air is cool and dry and the vegetation scanty, it diminishes greatly or disappears altogether. It is the product of heat, moisture, and vegetable decomposition. It appears to be absorbed largely and retained by the soil, and is given off on the first fall of rain or on turning up the ground, in sufficient intensity to produce disease in susceptible persons exposed to it. In districts where it exists, anything which retards a free circulation of air, such as jungle, forests, high walls, or similar impediments, adds to its force. And on the other hand, everything which tends to lower the standard of health of persons exposed to it increases their susceptibility to its influence. This malaria is universally believed by the natives of India to be conveyed in the drinking water.

The production of malaria can be checked by withdrawing any one of the three elements, on the co-existence of which it depends: but the experience of colder climates would appear to prove that subsoil water has more influence on its production than high temperature. High temperature, with a moist state of the air and subsoil, are

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the chief agents which influence the rapid decomposition of dead organized matter, while at the same time they produce a certain amount of susceptibility to disease in those exposed to them. Indian climates have therefore the double disadvantage of generating malaria and increasing its deleterious influence on health.

Whether it may ever be possible to banish this scourge from the soil of India it is hardly within our province to inquire, and the question could hardly be answered; but it is satisfactory to know that it has everywhere disappeared before clearing, subsoil drainage, and improved agriculture, changes which involve the removal of all excess of decomposing organized matter, and of water, the main element of decomposition; by which, moreover, the soil is repeatedly exposed to the action of the air, and brought under the influence of living vegetation. Part of the deadly terrai of Northern India has become comparatively healthy by clearing away the forest and cultivating the soil. 5456.

Considered with reference to its effects on particular stations, the extent to which malaria prevails appears to depend very much on the physical constitution of the surface and subsoil. The terrai, where it is most fatal, is a belt of country of greater or less breadth, situated at the foot of mountain slopes, formed to a great extent of débris, receiving and retaining a large amount of water from the higher levels, and covered with a dense vegetation, which, in the course of ages, has formed a rich, deep, vegetable soil.

In river deltas the conditions are somewhat similar, for they also are formed of débris and vegetable mould covered with vegetation and saturated with water.

The low banks of rivers, along which the subsoil becomes infiltrated with water, reproduce similar conditions.

Retentive soils, having imperfect natural drainage; expanses of shallow partially dried-up water; neglected tanks; hollows filled with water; marshy ground, and damp or wet ravines, are all well-known sources of malaria in India.

There are also porous soils which retain a large amount of moisture by capillary attraction apparently. To this class appear to belong the red earths and decomposed mountain rocks, especially granites; but the most common cause of the anomaly of porous soils giving off malaria is the existence of retentive beds below them,

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keeping water at no great depth below the surface. In some anomalous cases of this kind impure drinking water may possibly be an overlooked cause of disease.

A certain physical configuration of the surface, marked by the presence of valleys running up mountain slopes from the low country, is a cause of malaria being carried up mountain districts for thousands of feet above the terrai where it had its origin. Mr. W. Elliot states that he has seen several instances of this. In one such case a whole family living in an otherwise healthy locality was
4258. swept away by malaria rising from the low country. He says that a mist is seen rolling up the valley with the breeze, and that the malaria is taken up in that way. It is hardly necessary to insist on the value of this experience as affecting the choice of stations even on the hills. But the importance of these and similar facts was not recognized when stations were first occupied, and many of them were placed in deadly localities, which had in the end to be deserted after great cost had been incurred in their formation.

In the present state of Indian drainage and agriculture it is clear that for all practical purposes we must assume the three peculiarities we have enumerated,—heat, moisture, and malaria,—as constantly present and everywhere influencing the sanitary condition of the country. These are ever tending to lower the general standard of health, and to predispose to epidemic diseases, but they are by no means the only causes in operation, although they exert a potent influence on the comparative intensity of other causes. The presence of any or all of them has the effect of rendering other causes of vastly greater importance than they would be *per se.* Negligence, or the absence of precautions, which, in cooler climates, would lead to little or no result, good or bad, become of great importance in India. A trifling degree of impurity of the air brought about by a stagnant state of the atmosphere, or by overcrowding and want of ventilation in a barrack or station, may lead to a fatal outbreak of disease. Impurity in the water supply, such as would be attended with comparatively little influence on health in England, may, in India, determine an endemic attack of cholera or dysentery. Some apparently trivial inattention to cleanliness or drainage, of every day occurrence at home, may lead to disastrous results where a number of men are crowded together on a small area.

Topography and Climate.

Personal habits, indulged in with impunity in this country, send men in large numbers to hospital in a climate where personal hygiène is as important as is public hygiène to the interests of the State.

In short, the whole sanitary question as regards India must be considered from this point of view, not only by the Government but by commanding and medical officers. The supreme importance of apparently trivial causes of disease is the lesson to be learned by all our past experience, and not till this is thoroughly understood and practically acted on will any great good be done in reducing the high mortality rate of the Indian army.

The evidence given before us by numerous witnesses, and also that contained in reports from the stations, clearly show that European troops during the period of their service in India are exposed to very important conditions besides those arising from climate.

We shall begin the consideration of the various influences affecting the health of the European soldier in India by a brief general statement of the nature of his service.

RECRUITING AND PASSAGE OUT.

Recruiting and Transport.

Dr. Duncan Stewart, surgeon to the recruiting depôt for the Indian army at Warley, states that the usual recruiting age lies between 20 and 35 years, and that it differs in the different arms of the service, but that a great 599.
many have entered under 20. Recruits from all parts of 605.
England were assembled at Warley, and sent to sea in detachments of from 200 to 350 men. It was the custom for men to enlist for particular arms of the service; but sometimes they were transferred at the depôt from one arm of the service to another. On arriving at Warley they were carefully drilled under cover. At first they suffered from change of habits, diet, &c., and there generally was an average of about 6½ per cent. sick in hospital. Notwithstanding every care in selection, men were sometimes
sent back from India as unfit for service. The average 610.
time spent in depôt before the mutiny in 1857 was four months. At the time of the mutiny it was about six weeks; and it happened occasionally that men were embarked for India on the day of their arrival at Warley.

The troop ships are stated to have been always good 625, 6.
and specially ventilated. It used to be the custom to pay

RECRUITING AND TRANSPORT.

head-money on those landed in India. This has been discontinued, but, so long as it existed, the practice made it directly the interest of the medical officer to attend to the sanitary condition of the men.

Of late years a special code of instructions for troop ships has been in use; and no doubt great attention has been latterly paid to the health of the men while at sea.

One very injurious practice until very lately existed in permitting the issue of spirits during the voyage, and even the latest Queen's Regulations require no more than that the spirit should be mixed with three parts of water, and not issued till after dinner.

There are three points which require notice in this system of recruiting:—

1. Many of the men are exposed to laborious duties in a tropical climate at too early an age, and before the constitution is fully formed.

2. The period of drill is in any case too short, because it necessitates completing drill after the men arrive in India, and all the dangerous fatigue and exposure consequent on it in an Indian climate.

821. Deputy Inspector-General Stewart has pointed out the necessity of greater attention being bestowed on these conditions of a soldier's service. He states that no man ought to go out to India under 20, or from that to 25; and this opinion is supported by a great amount of testimony contained in the reports from the stations. Dr. C. Smith states that for the first few years of service men are very apt to suffer from fevers and inflammatory diseases, partly from greater constitutional liability, partly from inexperience in the case of young soldiers arriving in India, who take no care of themselves at all. Sir A. Tulloch is of opinion that recruits might be enlisted at 18, provided they had two or three years' training in a temperate climate before being exposed to a tropical climate or to the fatigues of a campaign. All the evidence derived from the stations is to the effect that none but fully drilled soldiers should be sent to India. The only question on which any difference exists is the place where the troops should be drilled. It has been proposed that the drill should take place at some intermediate station, as, *e.g.*, at the Cape, for the purpose of accustoming the recruit by degrees to change of climate. But the great preponderance of the evidence is in favour of completing the drill at home, and sending the soldier fully

Vide abstracts of stational reports.

1607, 8.

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Vide abstracts.

RECRUITING AND TRANSPORT.

formed, both as to age and habits, direct to his destination.

4458, 9.

From want of attention to these primary conditions, growing lads, who are very susceptible to disease when weakened by fatigue, have been sent out to India to learn their drill; their unformed constitutions are exceptionally liable to injury, and the over-zeal of an injudicious commanding officer or adjutant may lead to loss of health and efficiency, if not of life.

We have here, then, a well-known preventible cause of disease, or rather of predisposition to disease, which can be put a stop to. It is true that under the altered circumstances of the army since the amalgamation of the two services these evils will be less likely to occur; but, anyway, the past experience is sufficient to prove that they should be avoided in future.

3. As regards the issue of spirits on board ship, there cannot be a doubt that the practice has been injurious to the health of the army. It can easily be understood how this arises, when it is considered that men, having little or nothing to do during a three or four months' passage, may gradually contract a taste for spirits which they never had before; and of course, immediately on arriving in India, they proceed to indulge themselves with any kind of intoxicating drink they can most easily obtain, so that on their first arrival in a dangerous country the habit acquired on board ship may lead, as indeed it has led in a great number of instances, to the destruction of health and life. Lately an issue of malt liquor has been made on board ship, but still the Regulation allowing the use of spirits is in existence, and ought to be repealed.

Queen's Regulations, 1859, pp. 338 and 360.

3530–46.

An issue of malt liquor, cheap light wine, or temperance drinks, tea, &c. is recommended by Dr. Bird. On board many ships in the mercantile navy the issue of spirits and beer has been altogether discontinued, with great benefit both to health and duty; and the example is quite sufficient to show that spirits at all events are not amongst the articles of a soldiers' ration on board ship which are indispensable either to his health or comfort.

In former times little or no attention used to be paid to the season at which troops were landed in India, and it was mere matter of accident whether or not their first introduction to an Indian climate was at the healthy or most unhealthy period of the year. On landing at any of the presidencies no efficient precautions used to be

RECRUITING AND TRANSPORT.

taken in the way of dress, diet, or accommodation, or for preventing the men from falling into intemperance and dissipation. After landing they were forwarded to their destination without much regard to season or means of conveyance. Not unfrequently, when boats were used, they were overcrowded, badly ventilated, and otherwise insufficient for the purpose, and fatal epidemic attacks used to decimate the troops on board. These great evils have of late years been gradually abated to a considerable extent under Lord Ellenborough's administration, as stated by Col. Durand; but we think it right to 5093. mention their existence, because they in some measure account for part of the greater susceptibility to disease and the much higher rate of mortality which formerly existed in the Indian army. At the present time we believe that troops are as far as possible landed at the beginning of the cold season, that they are much better cared for now than formerly, but that even at present there is great risk on their first landing, from facilities for intemperance, which perhaps might be avoided, to a great extent at least, by additional care. The present practice is to forward troops direct from the port of debarkation to their regiments.

Where railways exist they are made use of; water conveyance is generally by means of well-appointed steamers, or a better description of country boats: and where neither of these means is available, the troops are conducted by short marches in the early morning.

The present practice is hence a great improvement on the former one, and has been attended with corresponding improvement in the health of troops.

DUTIES, &c.

DUTIES, &c.

3252. The soldier's duties at stations consist of the usual guards, of drills and parades before sunrise or at sunset, and are described by Colonel Greathed as follows :—

"At gunfire he goes to parade, and, as a general rule in barracks, he gets his breakfast at eight o'clock; at half-past ten he parades again in the barrack, when the officers go round the barracks to see that they are clean. Then there is a roll-call again at dinner-time, and a roll-call at evening parade; then he has his supper. After that time he is free till tattoo, which is at eight or nine o'clock, according to the season. There are roll-calls during the night in all barracks, if men are supposed to be absent; it is done by the serjeant-major, and that is by what is called the check-roll and if there are two or three men absent the check-roll is called. **Duties, &c.**

"3253. Does not that mean that the whole barrack is disturbed?—Yes; but it does not often happen.

"3254. For how many consecutive hours is the soldier on guard?—For 24 hours.

"3255. Does the practice in India differ from the practice at home in that respect?—No.

"3256. How many nights a week is a soldier in bed?—It varies occasionally; he is from 13 to 15 nights in bed very commonly; that is to say, that he does not come on guard above once in 13 or 15 days.

"3257. You mean that he is 13 nights in bed for one night out?—Yes.

"3258. Do you think that the amount of duty performed in India is greater or less than that which is performed in England? —It is less; there are no fatigue duties, or very few, compared with what they have in England; for instance, the fatigue duties of sweeping out the barrack-rooms, cooking, and carrying dinners to the men on guard, which is the most cruel thing upon the men at home, of all the duties thrown upon the soldier. That the soldier has nothing to do with in India, because his cook always goes with him."

As far as concerns his duties, the soldier cannot be said to be exposed to excessive fatigue if the Regulations are strictly complied with. But there are complaints that troops are sometimes unnecessarily subjected to duties after sunrise, and (as already mentioned) to drills. In this, as in other things connected with the soldier's duties and habits, Col. Durand states that "a great deal "depends on the wisdom of the commanding officer: the "wisdom of the commanding officer is really a thing of "very immense importance in India, for almost every-"thing is in his hands." Evening drill is complained of, apparently because it comes after dinner, so as to interfere with digestion. There is a concurrence of testimony to the fact that night duties, even in that climate, hardly ever act injuriously on health. 5142, 3. Stational Reports.

ACCLIMATION.

We have already shown, statistically, the influence of length of residence in India on the rates of mortality among soldiers. But there has been considerable difference of opinion as to the effect of acclimation on the health and efficiency of troops. It has been stated, on one hand, that men get accustomed to the climate by length of residence, and hence that there is hardly a **Acclimation.**

ACCLIMATION. period, so far as health is concerned, to which their term of service should be limited.

Others again have arrived at an opposite opinion, and
1293. one much more in accordance with observed fact. Dr. John McLennan, when asked whether a man of one year's service or of ten years' service would be the more able to endure fatigue and exposure, answers, "The fresh man, decidedly."

3303. Col. Greathed says, "I believe that the medical officers "will say that the longer a soldier remains in India the "worse he gets. And I believe there can be no doubt of
3304. "it; I do not believe in acclimatizing." "For the first "five or six years a soldier is a very good man indeed "in India, but after that he begins to break down, and "he is not so good a man as he was."

159. Sir Ranald Martin states that all statistical observations go to disprove anything like acclimation in the East Indies. On the contrary, he says, disease and death increase with length of service and age.

The opposite opinion seems to have arisen partly from the circumstance that some men have learned by experience the art of managing themselves, and so of preserving their health in unhealthy districts, and partly from confounding the effect of heat and moisture (*i.e.*,
3634. climate) with that of local sanitary condition. There *is* "acclimation" to heat; there is none to "endemic "miasmata."

Vide abstracts. The whole tenor of the evidence in the stational reports is against the doctrine of acclimation, as generally understood, and in favour of limiting the period of service in India to about 10 years. It does not, however, necessarily follow that this limit need be maintained, if the sanitary condition of the troops be improved, as it may be.

CAUSES OF DISEASE.

CAUSES OF DISEASE. Following up the history of the soldier after his arrival in India, we next proceed to inquire into the condition of the stations where he serves, his barracks and hospitals, his habits and pursuits, dress and diet, in order to ascertain whether (and, if so, what) unfavourable conditions are superadded to those attending on his recruitment and introduction to service, which can account for the high rate of inefficiency and death shown by Indian statistical returns.

CAUSES OF DISEASE.

In the course of the inquiry we have collected a large mass of most important information on all these points. But before discussing it, we shall give the general results of the evidence, showing the nature of the causes of disease which have arrested the attention of different observers, beginning with those which are incidental to the climate and country.

129. Sir Ranald Martin states that "taking any one cause, "he should say that the union of heat, moisture, and "malaria constitutes the most powerful one in destroying "the integrity of the European soldier's health, and con-"ducing to his fall by disease." And he goes on to state that "a certain amount of destruction and deterioration 130. "of European health must result from a residence at the "stations on the plains, even if the soldiers were put "into palaces."

132, 3. But while laying this down as a fundamental sanitary principle, he says, at the same time, that there is a very great difference between the health of the officer and that of the soldier, always in favour of the officer. And that there is also a difference between the health of the officer and that of the civilian, always in favour of the civilian.

134. We have thus three classes of Europeans exposed to the same conditions of heat and malaria, presenting three quite distinct rates of sickness and mortality; a fact which indicates the existence of other causes of disease, operating with different degrees of intensity in each of the three classes.

5479. Dr. Falconer considers excess of heat and excess of moisture as among the irremovable causes of disease in India, and as those which tell most upon the health.

1520. Dr. Colvin Smith attributes the largest amount of injury to a malarious climate. But, then he adds to this, as of equal importance, intemperance and syphilis; and he says, "these are the three things which generally break up the "constitution of a man in India."

3592. Dr. James Bird says that pure liver disease, and that accompanying dysentery, are produced by the predisposition caused by a high temperature, followed by cold.

1226. An opinion similar to that expressed by Dr. C. Smith, as to the prevailing causes of disease, is entertained by Dr. John McLennan, who attributes the largest amount of injurious effect on the health of the soldier to climatic influences, intemperance, and sexual disease.

CAUSES OF DISEASE.

This evidence, which contains the opinions of men of great experience, implies only that these causes, all but one of which are removable, lower the stamina of the body, cause ill health, and predispose to, and under certain conditions induce, disease. But all the witnesses admit at the same time the existence of other very potent causes which, although not incidental to the climate, are nevertheless rendered of greater importance by it. Even with regard to the presumed irremovable cause, malaria, 3635. Dr. James Bird states that miasmatic influences are removed by hygienic measures, in India as in England; and 3653. he cites, as a strong proof of this, the case of Batavia, in which, by the effects of Dutch sweeping, cleaning, and draining, the most deadly city in the world had become a healthy and agreeable residence.

3654, 5. He states that miasmatic emanations had been removed both at Cadiz and Gibraltar, and he sees no reason why similar results should not be obtained in India.

All the other causes of mortality assigned by the various witnesses belong to the class which, in this country, are considered as removable. We shall state these generally and discuss them afterwards in detail. Some of them are connected with locality, others with defective barrack accommodation, and the remainder are attributable to bad habits or exposure on the part of the men.

99. Sir Ranald Martin states, in regard to epidemics, "of "all the causes which go to foster and maintain epide- "mics, the ill selection of localities, the structural defects "as to ventilation, drainage, cleanliness, and the personal "habits of the soldiers, are the important questions."

1221. With reference to outbreaks of cholera, Dr. John McLennan states that this disease is known to have a certain connexion with damp and moisture, imperfect drainage, impure water, improper articles of food, close badly-ventilated sleeping places, and generally with what may be termed a bad sanitary state.

4483, 4. Referring to dysentery and cholera, Surgeon-Major Grant says that, in his experience, the most influential cause of these diseases is overcrowding in barracks; and that in gaols he has observed the most appalling mortality from bad air. Even at hill stations, far removed above the influence of malaria, he attributes the prevalence of diarrhœa to neglect of ordinary sanitary arrangements. 4523. He also says that bad water is a common exciting cause of cholera in India.

CAUSES OF DISEASE.

Dr. James Bird states that—

3589. "Diarrhœa, dysentery, and fevers have prevailed, and have been attended with great mortality" at stations at which he has served, "from want of due precaution in the selection of sites. Cholera, as an epidemic, appears mainly to owe its development and origin to miasmata, favoured by elevated temperature, and peculiar atmospheric conditions of climate; this development being greatly aided by preceding established conditions of filthy endemic situations, badly-constructed and ill-ventilated habitations, unhealthy articles of food and drink, producing predisposition to disease, aided by unhealthy trades, and depraved moral conditions of vice and poverty. The other diseases are mainly local, and miasmatic in their origin."

The evidence shows that the local causes of epidemic disease in India are precisely the same as those which exist in this country, aggravated by a higher temperature and by the presence of malaria.

Personal habits, as before stated, have more to do with health in India than at home. Many indulgences, which are comparatively innocuous in a cold climate, especially those connected with diet and regimen, become of serious consequence to health within the tropics.

2941. Sir John Lawrence states that both men and officers are careless in these respects, and that their habits of life are very inimical to health; that the habits of a cold climate are extremely pernicious in India, and soon produce bad health and an increased mortality; that the men eat too much animal food, eating it sometimes twice 2942–6. or three times a day, irrespective of season or temperature; and that he thinks the Government might try to induce the men to use more vegetable diet in the hot weather.

2354. Dr. Maclean considers that the habits of life of the European soldiers are very unfavourable to health, for undoubtedly they are very intemperate, and they suffer much from ennui and want of occupation.

5551. Referring to the sources of disease within the tropics, Sir A. Tulloch says that he is disposed to regard idleness as one of them, and that the men would be more healthy if worked more.

2686. And Staff Surgeon McCosh states that in his opinion soldiers in India do a great deal too little for themselves; that anything that would keep them out of idleness and out of the grog-shops would be conferring a benefit upon them, and that they are never so healthy as when undergoing the fatigues of a long march.

CAUSES OF DISEASE. The causes of disease, described very generally in this evidence, are those connected with the selection of stations, the sanitary condition of stations, barracks, and hospitals, bazaars and native towns, the condition of the water supply, intemperance, and venereal disease, diet, occupation, and the want of means of instruction and recreation.

We now proceed to consider each of these in detail.

SANITARY CONDITION OF STATIONS, TOWNS, AND BAZAARS.

SANITARY CONDITION, &c. Important information regarding the topography and diseases of all the stations will be found in the stational reports, and in the abstract. We refer to these for details, and propose to introduce here a few examples only, illustrative of the general condition of stations.

Many of the stations occupied by British troops are either within or close to cities and towns, the inhabitants of which are decimated periodically by fevers, cholera, diarrhœa, and dysentery, connected with the most obvious local causes. The troops occupying this class of stations are exposed to any sanitary defects incident to the civil population, and suffer more or less from the same diseases.

Other stations, known to be unhealthy, have been selected from time to time apparently for military or political reasons.

2233. Referring to those in the Madras presidency, Deputy Inspector-General Maclean states that they were selected without any special regard to medical considerations, and that many of them were occupied merely because they happened to be the spots where the troops first pitched their camps on taking possession; that the nature of the soil, the water supply, and malaria were never thought of.

6, 7, 8, 9. Sir Ranald Martin says that stations have been selected without care; that no station he has ever visited was exempt from malarious influences; that the soils are damp, the situations low and ill drained, the surface irregular, the ground jungly, and some of the stations subject to flooding.

1024. Captain Nicolls, of the Madras Engineers, describes the stations on the plains as all of one description, the country being flat, with very slight undulations, just sufficient to carry the water into the nullahs; the hill stations being situated on a ridge or spur of a hill.

Sanitary Condition, &c.

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Many of the old stations have proved so extremely unhealthy that they have had to be given up, after having entailed a great loss upon the service. More care has been bestowed of late years in the selection of new stations. Some of these, Sir John Lawrence states, have been extremely well selected; some very badly selected; there is a great difference in them. 2924.

The difference as regards health is due to the nature of the country and to the position and comparative elevation of the station itself. The sea-side stations are, of course, all at or very near the level of the sea, and have the great advantage of the sea breeze; but this advantage has been neutralized by a site having been chosen close to some muddy tidal estuary, as at Vizagapatam; or the sea breeze has been cut off from the barracks by a high wall, as at Madras, until the wall was lowered by Sir Charles Trevelyan. The low country stations in the Bengal presidency are only a little elevated above the level of the sea, following in this respect the level of the river. Fort William, one of the largest and most unhealthy of the stations, although 67 miles in direct distance from the sea, is only 18·16 feet above its level, and only one foot above mean high water in the river. Dum Dum is 84 miles from the sea. It is 18 feet above mean tide level; but during the S.W. monsoon it is only two feet above the level of high flood tide; at this time the ebb and flow of the tide is visible in the ditches at the station. Berhampore is 76½ feet above the level of the sea, but it is three feet below high water mark in the river. Allahabad, an unhealthy station, situated at the junction of the Ganges and the Jumna, is 368 feet above the sea, and about 40 feet above the surrounding country.

The N.W. stations are at a considerably higher elevation. Rawul Pindi is about 1,500 feet; and the large station of Mean Meer is 1,128 feet above the sea.

Secunderabad, in the Madras presidency, has an elevation of 1,800 feet. Bangalore, which is the highest of the larger stations in India, is 3,000 feet above the sea level. Belgaum, in the Bombay presidency, is about 2,200 feet, and Poona is 1,800 feet above the sea.

Many of the most important stations are thus at a healthy elevation above the sea level, if the sanitary condition of the station were determined by this element. But they are all more or less deficient in another element

SANITARY CONDITION, &c.

of perhaps greater importance, viz., their relative level as regards the surrounding country. Generally speaking they are little if at all raised above that level; and sometimes, as is the case with the highest of them, Bangalore, part of the station is actually below that level. Some of the most unhealthy stations are close to river banks.

In the great majority of stations, water is found at a short distance only below the surface. The only means of arriving at an estimate of the depth is by the wells; but as water is being constantly drawn from them, they do not afford a very accurate indication of the water level in the subsoil. Thus at Fort William the water level varies in depth from 12 feet in the dry season, to 2 feet in the wet season, although the ground is at all times close upon the water level in the river. At Dum Dum the water level in the dry season is at a depth of 9 feet, and during the wet season of one foot from the surface. At Kirkee, the depth is at 33 feet in the dry and at 19 in the wet season. And so of the others.

As might be anticipated, the soils and subsoils vary very much. A few stations are situated on dry sandy soils. In others the underlying rock comes close to the surface. But in the majority the soils are more or less retentive of moisture, and charged with decaying vegetable matter, and damp.

The natural result of this in a warm climate is the production of malaria. It is by no means certain, however, that this malaria exists equally over extensive tracts of country. There is on the contrary reason to believe that, like every other local cause of disease, it is much more intense in some districts than in others. Some years ago, a committee was appointed to examine the effects of irrigation on health; and one of the most important facts elicited by the inquiry is stated by Deputy Inspector-General Dempster to have been the close proximity of some of the worst and some of the best localities. And applying this discovery to such stations as Cawnpore, Kurnal, Dinapore, Delhi, Ghazeepore, he says that nearly all these stations are irremediably vicious; but, nevertheless, he believes that good localities exist at no great distance from every one of them. Page 464.

Although, as has been already stated, more care has recently been bestowed on the selection of stations, this important duty is not conducted on any fixed principle. No specially competent class of officers has been appointed for the purpose. A Committee is usually constituted of a commanding officer, an engineer, and a medical officer, with certain additional members, who proceed to make the necessary inquiries, and report. No doubt the intention is to obtain the best practical advice and opinion, but very special knowledge is required for such a purpose, while the consequences of mistake may be so disastrous that any mere chance selection of officers for the duty should be avoided. The Committees should either be constituted entirely of men of known competence; or else certain officers specially conversant with the whole subject should be selected for this particular service, and placed as *ex officio* members on all Committees. Officers should never be taken for such a service by roster; nor should officials on the spot be entrusted with the duty merely because they happen to be there. SANITARY CONDITION, &c.

The selection of new stations should in short be considered as one of the most important sanitary duties, and should be a recognised part of the sanitary service of the army.

We next proceed to consider the sanitary condition of existing stations as it bears on the health of the troops. But in doing so it is necessary to include the sanitary state of native towns and bazaars, because not only is a part of the soldier's time spent in these places, but the mere fact of their proximity to European barracks must necessarily exercise an injurious influence on the healthiness of both barracks and hospitals, if the native dwellings are in an unwholesome condition. It is indeed impossible to separate the question of health, as it relates to troops, from the sanitary condition of the native population; especially as it regards the occurrence of epidemics, which, whenever they occur among natives, indicate a condition of matters dangerous in the highest degree to the troops in the neighbourhood.

Referring to this subject, Sir Ranald Martin says, that 5314.
when he was surgeon of the native hospital at Calcutta, he was always aware of the advent of cholera 15 or 20 days before it attacked the European population, by its prevalence among the natives, and that this was one of the reasons which led him to suggest sanitary improvements for Calcutta. The bad sanitary condition of this
large city is indeed so notorious that Deputy-Inspector 2138, 2146,
General Longmore who acted as sanitary officer at Cal- 2147.
cutta during the mutiny, does not consider it necessary

to describe it. He merely states that, as regards the chief part of the vast area covered by the city, that inhabited by the native population, the pestilential condition of the surface drains and yards, and many of the tanks among the huts and houses, would not be credited by any one who had not been among them. The influence in certain winds of these places is quite perceptible at Fort William, although there is a very good esplanade between the fort and the bazaars. He has no doubt that there would be much more mortality among troops, were it not for the esplanade.

This great city has grown up by degrees in the entire absence of any efficient sanitary supervision. There has hitherto been no proper drainage. The water supply has been defective and bad; and the houses are much overcrowded.

The sanitary condition of the town of Madras, as described by Sir Charles Trevelyan, is as bad as that of Calcutta. The soil upon which the city stands is white sand. The river Kooam, which passes through it, is a tidal estuary, receiving all the town drainage along its course; but as the mouth of the estuary is silted up for most of the year, it becomes a foul stagnant open cesspool, which is washed out once a year by the floods. Sir
5303. C. Trevelyan describes the drainage as being "extremely
5306. "defective." There are, he says, plenty of drains, in one sense too many, for they are offensive in the extreme, because there are no means of propelling the offensive matter and getting rid of it. The drainage is effected by open drains "of the most offensive and scandalous de-
5305. "scription." There are no means of flushing them, on
5309. account of deficiency of water; and such is the offensive state of the general atmosphere from these defects, that a high wall is maintained between the Government House grounds and the body of the town, in one of the most thickly populated portions of the town, expressly for the purpose of excluding the noxious smell that may issue from the drains, thereby excluding the sea breeze, and preventing the improvement of the adjoining part of the town, and thus greatly aggravating the evil.

The water supply for domestic use is likewise "ex-
"tremely deficient," and it has become partially deterio-
5315, 5308. rated by offensive matter from the drains. Sir C. Trevelyan states that the introduction of a pure water supply is an extremely popular subject, and extremely desired by the

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people; and that it is a matter of urgent necessity, on the commonest principles of duty, to provide it. He further states that the health of European troops must be 5317. more or less affected by those circumstances, and that he 5310. had proposed that the health of the European population of Madras should be improved (not by building a wall of separation between them and the natives, but) by power- 5314. fully acting on the conditions of health of the native population itself.

As to Bombay, the evidence contained in the Station Report is of a similar character. The population is between 400,000 and 600,000. The drainage is very defective, the native houses generally in a filthy condition, with much ordure within their precincts, which has been accumulating for years. Nuisance is experienced in the town barracks from the wind blowing over the densely-packed houses, and also in Fort George from butchers' shambles and public necessaries about half a mile distant. Cholera follows its usual law of propagation in Bombay as elsewhere. Dr. John McLennan states that those natives 1221. living in the lowest, worst ventilated, and dampest part of the island, particularly in such places on the shore, suffer most. He also informs us that cholera and bad fever at one time frequently prevailed in the European crews of vessels undergoing repairs in the dockyard, a close, badly-ventilated situation, not far from the opening of a drain running into the harbour.

Dr. Haines shows that in 1861, the 16,200 deaths* among the population of Bombay were chiefly by zymotic diseases; thus, 1,600 deaths were by small-pox, 1,251 by cholera, and 7,024 by fever.

After calling attention to the insular situation of Bombay, its invigorating sea breeze, excellent water supply, and the abundance of open space for recreation, he goes on to add that when the streets are widened, when the water supply is rendered accessible to all, and when house drainage, and an effective system of sewage have been established, "there is no reason why Bombay should not "rank among the very healthiest of tropical cities."†

The water supply at Agra is bad, and cholera has been fatal. Stational Report.

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* 10,559 bodies were buried, 4,736 burnt, and 905 exposed to carrion birds.

† Fourth Report on Deaths in Bombay, by Rob. Haines, M.B., p. x.

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Delhi before 1857 was said to be unhealthy. Sir Charles Napier,* however, held that it might, perhaps, be made as healthy as any part of India. "In most parts of India," he says, "the effects of man's imprudence are attributed "to climate! If a man gets drunk, the sun has given "him a headache, and so on. Every garden at Delhi, if "not kept clean, becomes a morass; weeds flourish, filth "runs riot, and Delhi is unhealthy. The result is, that "the grandest city in India has the name of being insalubrious, though it does not appear to have any natural "cause to produce sickness; no natural swamps which "would require vast labour, science, and sums of money "to overcome. Nothing evil, in short, that does not "appear to be of man's own creation."

The natural advantages of Bangalore are very considerable; but it has nevertheless afforded a high sick and death rate, and the population, civil and military, have suffered severely from dysentery and cholera. During the period included in the return from this station the barracks were bad, and their "conservancy," in the opinion of Inspector General Macpherson, worse. The natural drainage from the ridge on which the cantonment rests is good; but as it is not properly taken advantage of, the surface filth finds its way into the tank, which, during the dry season, supplies the dense native population with water. "Every obstacle," the Commander-in-Chief Sir Patrick Grant adds, in a note, "has been thrown in the way of "procuring a copious supply of pure wholesome water, "but it is hoped they are now (in 1860) in a fair way of "being overcome."

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Inspector General Macpherson further notices that the native population of Trichinopoly exceeds 100,000; that the streets are clean; but that the "environs of the "military cantonments are resorted to by the natives for "the purposes of nature," giving rise, "by the excessive "accumulation of surface filth, to offensive odours in"jurious to the public health."

Evidence of a similar kind might be adduced with regard to all native towns near military stations; but this brief statement of the sanitary defects existing in the seats of government of the three presidencies and at two or three of the more important stations is quite sufficient for the purpose we have in view.

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* Sir Charles Napier, Defects of Indian Gov., p. 271.

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It is satisfactory at the same time to be able to state that Bombay has recently been provided with an excellent water supply, and that extensive works of drainage have been undertaken at Calcutta.

In all native towns there is some system of cleansing and removing nuisances in existence; but this, though indispensable as far as it goes, constitutes only a small part of the sanitary improvement required. There can be no doubt that well-considered measures of water supply, drainage, paving, cleansing, and general construction in these towns would be attended with most beneficial results to the health of troops quartered near them. And as regards the native population, we concur in opinion with Sir C. Trevelyan, who says, "I consider that not only 5307. "the preservation of life and health is concerned, but the "strength and comfort and general efficiency of the "population are involved; they would be better and "abler men, women, and children for all the purposes "of life, if the average standard of mental and bodily "vigour were improved by the removal of these local "causes of a low state of health."

Every military station in India has its bazaars, mostly in close proximity to the European lines. They consist of huts or houses arranged on no general plan, and without any regard at all to sanitary conditions. They have grown up anyhow, and have increased with the bazaar population, which always bears a very high proportion to that of the European troops at the station; *e.g.*, Bangalore, already referred to, has accommodation for about 1,700 European and 2,600 native troops. The native population within the cantonment is 124,000, three-fourths of whom live in the bazaar close to the European infantry barrack. There has hitherto been no limit to the proximity by which these large native populations may approach European barracks, nor to their position as regards prevailing winds. There are no regulations as to the general arrangement of the houses, the width or direction of streets, drainage, or water supply. The habits of the natives are such that, unless they are closely watched, they cover the whole neighbouring surface with filth; and if there be any ravines or pits in the neighbourhood they convert them into dangerous nuisances. There are generally no public necessaries. There are often open cesspits among the houses. The surface drainage sometimes flows into tanks, from which the water supply is derived. Surface

Stational Reports, *passim.*

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cleansing and removal of nuisances are enforced with more or less efficiency by the bazaar magistrates, but, in the absence of both paving and efficient drainage, it is impossible to effect either object satisfactorily.

52–3. Sir R. Martin describes the cleansing and drainage of bazaars as quite deficient, and recommends systematic medical police arrangements for the purpose.

645. Deputy Inspector-General Stewart states that the natives generally retire to neighbouring ravines, where these exist, and that there used to be, generally speaking, no proper police to maintain cleanliness.

3906. Sir Proby Cautley gives the following account of the bazaars at Cawnpore:—

> "To give the Commissioners an idea of the state of these bazaars, I may mention that the natives build their huts entirely of mud dug out of holes as near as possible to the place where they build. In the Cawnpore bazaar I came upon ponds full of black mud and all sorts of filth, and the whole place was utterly unventilated, which was a very remarkable illustration of how ill-health was produced, not only in the immediate neighbourhood, but all round the place."

3907-8-9. He states that the practice of pond-making, as a receptacle for refuse matter, is common to every town bazaar in India. They dig the mud for the huts close by, and do not fill in the hole again. This hole serves to receive all the filth of the town, where it remains exposed to the sun. As a bazaar becomes more populated it becomes less ventilated, and in time a very serious nuisance.

The Reports from the Stations confirm these general statements given in evidence, and show that in time past bazaars have been neither more nor less than native towns of the worst class, which have grown up in and around military cantonments, without any suspicion having been apparently excited, in the first instance, as to their probable influence on the health of the troops.

The bazaar police is more efficient in some stations than in others, so that all bazaars do not present the same
3132. defects; and the regulations are considered to be very good, as far as they go, provided they are efficiently carried out.

The evidence on the structure and arrangement of stations shows that there is a considerable difference
13, 19. among them in these matters. The older stations are all more or less defective in many most important points. Sir R. Martin describes the arrangements of barracks and

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hospitals, with which he is conversant, as very deficient. He says that there has been a great neglect of the means of cleansing, and that the drainage is almost universally insufficient for the purposes of health.

In many of the older stations the buildings are so placed towards each other that the free external movement of the air, a condition essential to health in India, is obstructed so as to render the air positively stagnant. Sometimes high walls surround the buildings so closely as to produce the same result.

This class of defects, though existing more or less in most European stations, is most common in native lines, where the huts are often placed as close together as they can stand.

In new stations, such as those in the Punjab, at Umballa and Poona, there is more regularity of structure, and the different barrack buildings are sometimes arranged *en échelon* to catch the prevailing winds.

But the older stations are very irregular, as *e. g.*, the barracks at Madras, which consist of closed squares of buildings, at Cawnpore, Dinapore, &c., where the buildings are arranged so as to make good ventilation impossible. 1065.

In fortified stations the barracks are often very much crowded together, and some of them are in bomb-proofs, hardly fit for human habitation in such a climate.

DRAINAGE OF STATIONS.

DRAINAGE OF STATIONS.

Stational Reports.

All the stations are surface-drained with more or less efficiency, but with very few exceptions this is the only form of drainage which exists at any Indian station. The surface drains are either mere cuts in the ground, or they are formed with brick or some other material; and are led to an outlet, generally a cesspit, a ditch, or a ravine or nullah, where such exists. But very often the water is conveyed only to a certain distance from the barrack, and left to provide an escape for itself. The whole procedure is that usually adopted for camps, and is wholly unsuitable for permanent stations. Colonel Greathed states, as the result of his experience, that when there is a heavy fall of rain, it is very commonly not carried off as well as it might be. Even this surface drainage is executed on no general plan. Sir Proby Cautley states that one reason of the defective condition of the surface drainage is that the drainage of cantonments is generally done in detached bits, instead of being carried out comprehensively. He

1698. 3105. 3905.

DRAINAGE OF STATIONS.

states that the want of drainage has been a general defect, but that latterly great improvements have been effected; that he attaches great importance to a proper system, and that, were it carried out, he is of opinion that such places
3912–17. as Cawnpore, Delhi, Kurnal, would be comparatively free of disease. The annual mortality at Cawnpore has been as high as 91 in 1,000, chiefly from fever, dysentery, diarrhœa, and cholera; which Sir Proby Cautley states, has been due to the condition of the station, the want of
3928. drainage, and the filth in the bazaar. And on being asked whether he considers Cawnpore a fair illustration of the
2922. general defects of drainage in India, he replies, "A very good illustration," admitting at the same time that it is perhaps an extreme one. Sir John Lawrence considers that drainage has not been cared for so much as it ought, although it has been improved considerably of late years.
1697. The flushing of the surface drains is generally left to periodical rains, or they are swept out by the native establishment.

The abstract of stational reports gives information as to the condition of the drainage at most of the stations.

So far as we can learn from these reports, there appears to be no method of conveying away the roof water from buildings, which consequently sinks into the ground where it falls, and accumulates moisture close to the foundations of both barracks and hospitals. There is no such thing as subsoil drainage carried out at any station. The rainfall no doubt partially runs away by the surface drains; but the great bulk of it, amounting to many feet in depth during each rainy season, goes to saturate the subsoil with water. The conclusion of the rainy season is generally attended with a great increase in epidemic diseases. And, inasmuch as wet or damp subsoils are well ascertained causes of this class of maladies, even in cold climates, in such a climate as India the neglect of subsoil drainage within the area of stations is doubtless one great cause of increased sickness and mortality. Indeed the effect of undrained subsoil on health is well known in low-lying stations throughout India.

3426–30. The floors of barracks and hospitals are often damp from this cause. Dr. James Bird cites, as an illustration, the case of Colaba, which was not sufficiently drained; the barracks were extremely unhealthy, and about 85 per cent. of the sickness arose from fevers. The floors rested on the ground, and water could be found within three feet of the surface. Such sites, he continues, produce a large amount of sickness, and a large amount of mortality generally. DRAINAGE OF STATIONS.

Major-General Goodwyn mentions the case of Berhampore, in which the barrack square was pretty well drained; but the marshy state of native lines and of the parade ground, was a cause of unhealthiness. 1672.

In regard to Berhampore also, Dr. George Wallich says, "There is one part of it so unhealthy that Europeans "will not live in it. One house has the name of 'Fever "Hall;' and as certainly as any one goes to live in it, he "takes fever." 5840.

The reason assigned for the absence of any but surface drainage is the want of sufficient fall at many stations; but if there be not fall enough to enable the subsoil to free itself of moisture, the ground is certainly unfit for occupation by troops, unless the water were pumped up and removed by machinery. All stations are not equally deficient in this respect; there must be many with fall enough for every purpose towards an available outlet. 1032.

There is, of course, no drainage for conveying away any of the fluid refuse of stations. In the majority of instances, this either passes off by the surface drains, or it is run into shallow cesspits, from which it is removed by hand, and carried or carted away. Sometimes the fluid refuse is passed into deep cesspits, at no great distance from the barracks, with the view of its draining into the subsoil; the water from the subsoil being, at the same time, the source which supplies the wells. Stational Reports.

Neither latrines nor urinals are drained. For all the purposes to which drainage is applied in this country, as a means of preserving health, it is unknown in India. Our cities and towns, as well as our home stations, have been or are being drained, because the absence of drainage is well known to be fatal to health; while in the hot moist climate of India, no effectual step has been taken as yet to introduce this indispensable sanitary improvement.

The present surface drainage is altogether insufficient for conveying away fluid refuse. The drains are very liable to fall out of level, and to accumulate foul water at points dangerous to health. Were they ever so perfect in construction, they could only remove that part of the rain-fall which happened to flow into the surface drain along its line; but this would leave the subsoil charged with water and organic matter washed into the surface, DRAINAGE OF STATIONS. the tendency of which is to render the ground more unhealthy (by the generation of malaria) than it would otherwise be, and, in course of time, to make it uninhabitable.

The evidence given before us, as well as the stational reports, when carefully considered, all go to prove that the drainage of Indian stations on a well-digested plan to suit local circumstances, is a work of urgent necessity for improving the health of the army.

IRRIGATION.

IRRIGATION. Considerable discussion has arisen as to the effect on health produced by works of irrigation carried on in the vicinity of stations. To increase the productiveness of dry soils the waters of rivers are conducted over certain parts of the country in canals, large enough for inland navigation, and the supply is let to cultivators, who are permitted to draw and apply it in their own way. In some places water for irrigation is collected in reservoirs. The land itself being undrained, can only take a certain definite quantity of water without producing malaria; but the natives give little consideration to this, and they flood the surface. The influence on health of this method of irrigation has varied in different districts of India. In the Madras Presidency, both Major-General Cotton and
2044, 2320. Deputy Inspector-General Maclean, state that no injury to health has been observed even among Europeans. In the Bengal Presidency, careless application of water is attended by prevalence of periodic fevers and spleen disease, which has led to the prohibition of irrigation within a considerable distance of military stations,—five
3971. miles, as regards rice cultivation. A committee was appointed to examine into the alleged unhealthiness of the process. They found that whenever the soil was of very tenacious character, and too much water used and allowed to stagnate, disease showed itself. There is no evidence in any of the Stational Reports of the production of fever by land under irrigation; and so far as concerns the native population, the advantages of a water-supply for agricultural purposes are so very great and so intimately connected with their well-being, that the question which arises is, not whether the irrigation should be
3967–3992. discontinued, but how it can be continued without injury to health.

In Southern India it appears to produce less injury

IRRIGATION.

than in Northern India, but wherever water for irrigation is applied in any quantity, subsoil drainage is indispensable both for health and productiveness, and ought always to accompany works of irrigation.

WATER-SUPPLY.

WATER-SUPPLY.

The water-supply of stations, as well as of towns, is derived from three sources,—tanks, wells, and rivers.

In low flat districts, and in deltas, tanks are chiefly relied on. The supply at up-country stations is mainly derived from wells of from 20 to 30 feet, or more, in depth.

Stational Reports.

River-water is used where a river happens to be the most abundant and accessible source. The universal method of distributing the water is as follows:—It is drawn from the tank or well by dipping skins or other convenient vessels, and it is carried by water-carriers (bheesties) from its source to the barrack, and there emptied into such receptacles connected with cook-houses, ablution rooms, &c. as may have been provided for its reception.

At some of the larger stations the water is conveyed by bullocks. For drinking purposes an ordinary wooden barrel or jar is provided; the water is poured from the water-skin into it, and the water is drawn from the barrel by dipping.

It will be seen that the entire method of supply for permanent stations is the same as that usually adopted for armies in the field.

However requisite it may be to adopt it under the pressure of necessity, it is obviously unsafe to trust to such a method of supplying troops with one of the prime necessaries of life at all other times.

Somewhat similar methods have always been in use among uncivilized or imperfectly civilized populations. But in proportion as civilization has advanced, such rude and unsafe expedients have been relinquished; and greater attention is now paid both to the source from which water is derived and to the method by which it is distributed for use, especially in towns.

A considerable amount of useful and valuable evidence has been laid before us on this most important subject by distinguished chemists, two of whom are officers of health in the metropolis, and specially conversant with the whole subject. One of these gentlemen, Dr. R. D. Thomson, who has visited India, describes the state of the Indian tanks as "quite shocking." He states that he would 4754, 4796.

WATER-SUPPLY.

certainly not be satisfied if the population of his district (Marylebone) had no better water sources than those at the command of the Indian army, that, indeed, he would consider them very dangerous, and that he would expect 4798. a "very much higher" rate of mortality in the parish if the water-supply were of a similar kind.

Dr. Letheby, Officer of Health to the City of London, gives evidence to the same general effect. He is asked :—

> "4671. Supposing in an epidemic country you have superficial wells dug in a soil containing a large quantity of organic matter, and suppose the mode of drawing that water is by throwing buckets into the well, drawing the water up, spilling part of it upon the surface, part of the water being washed into the well again, and suppose that the water so drawn up is carried in skins, and distributed to the consumers, what do you think is likely to be the sanitary result of such a proceeding?—That I could hardly speak to, except from an examination of the water, but I should say the mode of distribution is very objectionable, and is likely to give the water organic impurities, and to make it, indeed, worse than it originally was. The soaking of the water from the soil back again into the well, and the redistribution of it in skins, must be a means whereby an additional impurity must be given to the water independently of that which was in it before.
>
> "4672. So that in a country where epidemic diseases prevail you would object, in a sanitary point of view, to that mode of distribution?—Yes, I should object to that."

In examining the objections against the present system of water-supply more in detail, it appears, that, with very few exceptions, the water from no source in India has been submitted to chemical analysis. In the exceptional cases given in the reports from the stations, the results of analysis, so far as they go, are by no means satisfactory as regards the purity of the supply.

At certain up-country stations, the well water contains a large amount of salts; and a similar excess of saline 5717. matter is observed in tanks, rivers, &c., during dry weather.

There is every reason to believe also that many water sources contain a large amount of organic matters, animal and vegetable; but in scarcely an instance is there any qualitative analysis given. The qualitative analysis of water from the wells and tank at Secunderabad, however, gives results of an extraordinary character. This station (which has suffered so severely from bowel diseases) is supplied with water from six sources, containing from 10 grains up to 38, 44, and in one instance 119 grains of solid matter per gallon; and of this amount it appears

Stational Report.

WATER-SUPPLY.

that organic matter of some kind or other exists to the extent of from above 2½ grains to 8, 11, and apparently, in one instance, up to 30 grains per gallon.

For all practical purposes, as regards the health of troops, the composition of the various water sources in stations may be said to be either unknown or too imperfectly known to be of any real use.

All we can gather from the evidence and the stational returns, is that some waters are considered good, some tolerably good, and some not so good. *Vide* Miss Nightingale's Observations, p. 347.

But in the selection of sources, it seems not to have been considered necessary to make any special inquiry on the subject.

In some exceptional cases the water-supply is stated to be peculiarly defective as to its purity, and "some very "good wells become dangerous from disuse." 586. 589

Again, it is the result of universal experience that shallow wells, such as those used in India, which receive their water from the rain-fall draining through a soil highly charged with organic matter, always contain a considerable amount of that matter in solution. In ground at a distance 4578. from human dwellings the organic matter will be chiefly of vegetable origin. But wherever there is a population on the surface, with neglect of ordinary sanitary precautions as to surface cleansing, drainage, and especially cesspits or other nuisances, the chances are that the wells will 4589. contain a considerable amount of animalized matter. Vegetable impurities in water rarely manifest their presence either by taste or smell. In some most fatal instances the 4582. presence of decomposing animal matter in wells has rendered 4598, 4603. the water containing it apparently more agreeable to the taste.

The extent to which these impurities prevail in shallow wells is much greater than the public is at all aware of. Dr. Thomson has given the constituents of 44 wells or 4725. street pumps in the parish of St. Marylebone (having a depth of from 12 to 20 ft.) containing from 42 grains to 133 grains of solid impurity per gallon, the organic matter varying from about 5 to 33 grains per gallon. All of these waters are unfit for use. Dr. Letheby says, in regard to 4589. these and other similar wells, "there is no shallow well at "all in London which contains pure water." As already stated, the cause of this impurity is to be sought for in the existence of organic matter in the soil.

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4060. An example of this in India is given by Colonel G. Campbell, in which certain wells at Lucknow became contaminated on account of a number of elephants having been buried near them. The recognized impurity of the water in this case led to its disuse. But generally, as stated by 4582. Dr. Letheby, these impure shallow well waters look clear, fresh, and rather inviting, because of the presence of carbonic acid, which gives them a sparkling quality, and because of their temperature and their slightly saline taste caused by the presence of nitrates produced during the process of decomposition of animal matter.

3435. Dr. James Bird states that the waters of Bombay, drawn from wells, contain a considerable amount of organic matter.

The water of open tanks is exposed to similar sources of impurity. They are dug in soils which have been for ages covered by a rich vegetation. They receive the drainage of the whole of the surrounding area, and during heavy falls of rain, whatever impurities there may be on the surface are washed into the tank, which is in fact the drainage outlet.

Some of the tanks are lined with stone, others are banked with more or less care, and kept free of vegetation. Some of them resemble ordinary horse-ponds; in some instances covered with a minute vegetation which, it is considered, rather improves the quality of the water, by assimilating its dead organic matter. It is the custom to set apart tanks for bathing and washing, and tanks for supplying water for domestic use, cooking and drinking. There is a tacit understanding that tanks of the latter class shall not be used for the former purposes, and sometimes they are guarded. Notwithstanding these precautions, the evidence shows that a large amount of organic matter finds its way into them.

The tanks used by Europeans are generally safer in this respect than those used by natives, but still their purity depends to a very great extent on the state of the surrounding surface, and the water is all more or less stag-
5856. nant. Sometimes the same tanks are used by European
2763. and native troops. The use of stagnant water has by itself been known to occasion ague; but besides this the Indian tanks are, many of them, exposed to pollution from filth, on account of the dirty habits of the natives, described in the evidence of Dr. G. C. Wallich, as follows:—

> "5855. Independently of that, the habits of the natives, who defecate all over the surface of the country, must necessarily cause

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the water in the tanks to become impure?—Yes, it is so; in point of fact the natives have no idea of taking sanitary precautions. For instance, a man will eat and drink and perform his evacuations actually on the very same foot of water, standing in it, or close to it; he has no idea of impurity as long as it happens to be Ganges water.

"5856. The European troops and also the native troops drink the water from these tanks?—Yes; there is nothing else for them, and the same causes will operate with Europeans in an increased degree."

After describing the same native habits, Dr. Mouat states that a heavy shower of rain washes down all soluble matter, through the natural percolation of the soil, and it must find its way into the tanks. 5788.

Speaking of the tanks used by the natives, Dr. Falconer says, that the purity of the water in them will depend upon the washing in of the surface, and upon the nature of that surface. If decayed vegetable matter or animal excreta were thrown out on the surface, and the rain drainage took that direction, the water in the tank would become tainted and unwholesome. 5402.

Taking into consideration the habits of the natives, and the general state of the surface near stations and towns, it must be evident that considerable danger to health must arise from the use of tank water.

Such a source of supply is not made use of for any military station at home, or indeed for any domestic purpose. Such water, even in this climate, is considered bad and dangerous, and in such a climate as that of India it is more so than at home.

We next come to consider the probable effect of this condition of the water-supply upon the health of the troops; and in doing so we shall have to be guided to a large extent by the experience obtained in sanitary inquiries at home. Dr. Letheby says on this subject:— 4564.

"I think I may say that not only myself but all the officers of health of the metropolis are of opinion that bad water is a frequent cause of disease.

"4565. And that it aggravates some of the diseases?—Yes, there is no doubt of that.

"4566. Do you mean that impure water itself produces disease, or merely that it predisposes to disease?—It does both. I believe, in the first place, when there is a natural tendency to disease, the condition into which the water will bring the alimentary canal will tend to establish that disease, or set it on foot; and that decomposing organic matter, in certain conditions of decay, in the

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alimentary canal is sufficient, without any other agency whatever, to cause disease.

"4567. So that next to impure air you would rank it as one of the most powerful causes of disease?—I am disposed to think it is before impure air, as being one of the most powerful causes of disease."

This evidence gives the experience up to the present time.

During all great epidemics popular opinion has pointed out the state of the water as one of the chief causes of pestilence, and modern experience has confirmed this by minute statistical inquiry. The diseases to which bad water peculiarly predisposes are mainly epidemic diseases, affecting the intestinal canal, such as cholera, diarrhœa, and dysentery.

4673. To the use of impure water have also been traced fevers of the intermittent type.

The evidence on these points is conclusive, and extends not only to well water but also to impure river water. During the cholera epidemic of 1848–9 several instances occurred in which nearly every person using water from particular wells was affected with diarrhœa or cholera, and of the cholera cases nearly all died.*

4598. During the epidemic of 1854, of 73 persons who died of cholera in a certain street in the metropolis, 61 had drunk water from a pump polluted by sewage, while the people who did not use the water were not so severely visited.
4774. A vessel of this water was sent to a lady at Hampstead,
4771. and she was attacked and died of cholera. The water, on being analysed, was found to contain 92 grains of solid matter in the gallon, of which 7·8 grains were organic matter. During the same epidemic the population of Southwark and Lambeth suffered severely from cholera, which was attributed to the state of the water-supply. The affected district was supplied by two companies, one of which gave a comparatively pure water, and the other a very impure one, containing sewage matter from the
4787. Thames. The deaths from cholera in the houses supplied by the purer water were in the ratio of 37 in 10,000, while the ratio among those supplied with the impure water was 130 in 10,000. This special case was the subject of elaborate statistical inquiries made by the Registrar-General's department. Referring to these facts, Dr. Thomson

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* Report on Cholera, General Board of Health.

says:—"Therefore I conclude that there were destroyed "by the Southwark and Vauxhall Company (whose water "at the time was impure) 2,500 persons." WATER-SUPPLY.

4569. In the same manner as the mortality from cholera has been diminished by the use of pure water has the mortality from dysentery also diminished.

In applying this experience to India it is necessary to point out that the diseases which our home experience has proved to be so strikingly under the influence of the quality of the water are the same diseases which bring so much loss and inefficiency in the Indian army. This fact would of itself lead to a strong suspicion that the water is impure. But it must also be borne in mind that the troops drink a large quantity of water, especially during the hot season, and that bowel diseases are generally most prevalent and fatal in the hot dry weather when the water supply is diminishing and becoming daily more impure from evaporation and want of rain. Sir John Lawrence, in his evidence, states:—

> "In India one great point upon which good health depends is the water; our people very seldom look to the water, but the natives always look to the water in choosing a locality. 3013.
>
> "3014. I believe that the troops drink an immense quantity of water mixed or unmixed?—Yes.
>
> "3015. Therefore it is important that the water should be of good quality?—Yes; I think that there is very great scope for improvement in the selection of sites in that way.
>
> "3016. In England we find that the water has a great deal to do with the mortality in cholera?—Yes; I have seen positions which were considered unexceptionably good by Englishmen, but if you asked the natives about one of them, they would say that it was very bad on account of the bad quality of the water."

In a district where there is a strong predisposition to bowel diseases, whenever even the inorganic saline impurities in the water exceed a certain amount, there is danger to health. The production of diarrhœa by such waters even in Europe is perfectly well known, especially at certain seasons; and the same fact has been observed in India. Dr. Mouat has no doubt that in a marshy district, 5717, 5718. impure water has a tendency to produce diarrhœa, especially when, in a very dry season, the wells, and even the tank water, are more or less loaded with salts; diarrhœa is very rife in those cases, and the same thing occurs from water that is drunk from tidal rivers; for even in the hot season, when the tides are very low, the water is to a certain extent brackish. He states that he accompanied a

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detachment of sailors to Assam during the mutiny, and the water was all taken in alongside from the river: a most frightful outbreak of cholera occurred within 24 hours after embarkation, and the men traced it to the water distinctly.

5838, 5840, 5842, 5843. Dr. Wallich states that there is a great quantity of impurities in tanks, that the water is "completely" "charged "with organic matter," and that the animal organic matter (in the tanks) is certainly a cause of fevers, dysentery, and cholera. But we cannot ascertain that there has been any attempt to estimate the nature and amount of the impurities, or their probable influence upon the health of the army.

4581. It is known that water from marshy districts in this country contains from four to five grains per gallon of vegetable matter, and that it would be considered injurious to health to use such water.

4849. As regards putrescent animalized matter, Dr. Thomson states that he would consider the presence of "any quan-"tity objectionable" in a country like India, where bowel disease prevails.

2753–4. Dr. Angus Smith states that, while three grains of peaty matter could hardly be considered bad in a sanitary point of view, half a grain of putrefying matter "might be "intolerable," and that water containing from five to six or ten grains of organic matter per gallon could not, he believes, be drunk, and could not be used at all.

The rude and imperfect method of distribution in use has already been adverted to as an additional source of impurity, which would not be submitted to at any home station.

5490. Dr. Sutherland, in reviewing the whole question in its reference to barracks, says, "We should certainly recom-"mend for our home stations the abolition of the entire "mode of supply of water mostly used at the Indian sta-"tions, both as regards the source and the mode of collec-"tion and distribution." "There has," he says, "been no "application apparently of any modern improvement, as "regards either the examination of water sources or the "means of collecting or distributing water for use for "stations, bazaars, or towns." He says that "the present "condition of the water-supply is one of the cardinal "defects in the sanitary arrangements of India, and that "it is unquestionably a predisposing cause of disease, "especially during the prevailing seasons of cholera, fever, "dysentery, and other zymotic diseases."

Water at Mean Meer, very brackish & scarce,
only one or two good wells.
Umbala. ditto & also scarce

WATER-SUPPLY.

The evidence before us goes to show the necessity of making a very careful chemical investigation of all the existing water sources at the stations, with the view of improving them, either by adoption of precautionary measures for diminishing the risk of pollution, or by selecting a purer supply. Any water sources which are found to 4835. be irremediably impure should be at once rejected. The 4839. purest water is that which is obtained from primary rocks, such as granite, mica slate, and clay slate, or such as is obtained from pastoral districts. Next in order of purity, but by no means so pure, is the water from agricultural districts, represented by rivers.

Deep wells afford good water, if care be taken to protect 2747. them from surface impurities, whether percolating through the soil or finding an entrance by the well's mouth. The water of shallow wells, as already stated, ought always to be avoided.

It is highly probable that a careful chemical inquiry would prove the majority of tank waters unfit for use.

In conducting these inquiries, the same method should 2743. be adopted as is followed in this country in supplying towns with water. The degree of hardness, by Clark's test, should be ascertained; next, the quantities of organic and inorganic constituents per gallon, their precise nature, and the amount of each.

As illustrations of the beneficial results of this method of procedure, it may be stated, that the impure water sources of the metropolis were abandoned and better water provided, with marked improvement in the health of the population; that a proposal to supply the city of Glasgow with well water was rejected after chemical 4742. analysis, and at a great expense, the people obtained a 4745. supply, the total impurities in which amount to 2·35 grains per gallon, of which only 0·605 grains consist of organic matter. If the chemical constitution of this water be compared with that of the supply of Secunderabad, already mentioned, a clear idea will be obtained of the great importance of chemical inquiry on such subjects.

It may be useful to state briefly the nature of the improved water sources, together with the methods of distribution which have been adopted of late years in this country. The purest waters are those derived from mountain springs or streams, collected and stored either in large artificial reservoirs in upland valleys, such, for example, as those for Manchester and Liverpool, or in

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natural mountain lakes, such as Loch Katrine, from which Glasgow derives its water. We have already noticed the small amount of impurity in the Glasgow water. Manchester water obtained from a hilly district contains 3·33 grains of impurity per gallon, of which ·680 grains is organic, chiefly peat. It is found highly advantageous in these cases to bring the water a distance of 30 or 40 miles in iron pipes; and as the reservoirs are at a considerable elevation, the water is discharged by head pressure, and can be delivered by gravitation all over the towns for which it is intended. This, though in the first instance a costly method, is the best and cheapest in the end, because it ensures a constant supply of pure water, and delivers it without the cost of machinery.

In many parts of the country such advantages cannot be obtained; and in these cases wells are dug to a great depth, until water-bearing strata are reached affording water of sufficient purity. Engine power is provided to raise the water into iron tanks elevated to a sufficient height above the ground to enable the town to be supplied by gravitation from the tank.

In other instances, such as the metropolis, water is derived from rivers, and distributed in a similar manner; but its purity cannot be so much depended upon. But even the metropolitan waters are pure when compared with those Indian waters, of which we have an analysis. The total impurities in waters supplied by the Thames companies may be taken at about 20 grains per gallon, of which from 1·24 to 1·76 grains consist of organic matter. Water supplied by other London companies contains a little more impurity.

As regards analysis, it is considered necessary not only to ascertain the comparative purity of a water source at the time of its selection, but periodical analyses are made from time to time, to see that no casual impurity has obtained admission.

In all the improved supplies the water is delivered from pipes to the consumers; a method of distribution which experience has shown to be absolutely necessary for health and cleanliness.

Purity, abundance, and facility of use are the three principles which require to be kept in view; and they are, if possible, of far more importance in India than at home.

It may not always be possible at the Indian stations to obtain purer sources of supply; but there can be always

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at hand the means of reducing the impurities to a minimum; filtration can be adopted everywhere, on any required scale, and the water obtained free of suspended impurities.

Of late years scientific methods have been applied even to the removal of organic matter held in solution by the water. A filter composed of bone-charcoal, with peroxide of iron, is found to oxidise organic impurities, so that the water passes through without any perceptible remainder. 4622–9.

It might possibly be practicable to obtain water for certain stations by having collecting reservoirs in hilly districts from which water might be laid on after careful filtration.

Whatever be the source, the water should be laid on to every barrack and hospital directly by gravitation, or, if local circumstances prevent this from being done, the water should be raised by mechanical power, and stored in tanks at a sufficient elevation to enable it to be distributed by gravitation. Any way the present method of drawing and distributing by hand labour should be discontinued for all fixed stations, with the least possible delay. As the rain-fall in India is irregularly distributed over the year, special arrangements are required for collecting and storing it up in the rainy season, or for recovering it from the earth and purifying it.

An abundant supply of pure cool water for drinking purposes is an essential requisite for all barracks. Nothing hitherto has been done in this direction; and we strongly recommend that drinking fountains be provided at all necessary points, both in the barracks and over the stations generally.

CONSTRUCTION OF BARRACKS.

BARRACK CONSTRUCTION.

With few exceptions, the barracks in India are constructed on one general model, varying in detail, especially in the dimensions of the rooms and in the number of men they are intended to accommodate. As already stated, in some of the older forts the barracks are casemated, or built in more than one floor; but in the other stations, the model is that of a hut with doors on opposite sides, which are protected by verandahs. In the more recent barracks, the detail has been varied by carrying the centre of the hut to some height above the sides, like a gothic church; the elevated part being supported on arches dividing the room into a centre and two side

BARRACK CONSTRUCTION.

aisles, with verandahs outside. The beds are generally arranged along the side walls, two and two between the doors. In the simpler form of construction there are two rows of beds in the room; but where the room has aisles there are four or even six rows of beds between the opposite doors, the inner rows of beds being placed with their heads to the piers of the arches. In the most recently constructed barrack in India, the Dalhousie barrack, at Fort William, there are six rows of beds between the opposite doors. The dimensions of barrack rooms vary very much. Among the smallest rooms are those at the new station of Mean Meer, 48 feet long by 24 feet wide and 24 feet high; they are intended for 16 men each, and to give 1,703 cubic feet, and 72 superficial feet per man. The temporary barrack rooms at Hazareebaugh, built on the standard plan, are intended for 100 men each, at 1,080 cubic feet and 63 superficial feet per man; these rooms are 300 feet long, 20 feet wide, and 18 feet high.

Stational reports.

The Secunderabad barrack rooms vary in length from 124 feet to 274 feet; they are from 18 to 24 feet in width, and from 16 to 25 feet high; they accommodate from 20 to 104 men per room, giving about 1,000 cubic feet per man, and from 40 to 56 superficial feet. There is a barrack room at Trichinopoly no less than 1,011 feet long by 18 feet wide and 17 feet high. At Allahabad the rooms are 335 feet long by 22 feet wide and 16 feet high, holding 100 men per room. The barrack rooms at Dumdum, intended for from 30 to 38 men, are about 105 feet long by 22 feet wide and 14 feet high; giving about 1,000 cubic feet, and 70 superficial feet per man.

Probably the longest rooms in existence are those in Fort St. George barracks, at Madras; the lower room is 1,483 feet long by 18 feet wide and 15 feet 6 inches high, and holds 400 men; the upper room is 2,124 feet long by 20 feet wide and 14½ feet high, and is intended for above 600 men; the space per man is 1,000 cubic feet, and the superficial area from 64 to 69 feet. The Dalhousie barracks (already alluded to) at Fort William, contain what is virtually one room on each floor, although it is divided by piers and arches into three breadths, exclusive of verandahs: the length of each room is 287 feet 4 inches, the width 64 feet 5 inches, and the height 19 feet; each room holds 306 men at from 1,500 to 1,600 cubic feet, and from 79 to 85 superficial feet per man.

BARRACK CONSTRUCTION.

Nothing can be simpler than the hut with its four walls, roof, and verandahs, which is the model on which most of the Indian barracks are constructed; but in the majority of cases it has been so used as not only to lose its advantages, but to become an unhealthy model of a barrack. An essential condition of every barrack room is that the air in it should be as pure during the night as the air outside; but it is impossible to ensure this if the rooms are above a certain size, and contain above a certain number of men. The healthiest of all sleeping rooms are those which, like the huts of the native troops, contain one or two people, simply because they are so easily ventilated. Whenever the number of inmates exceeds 20 or 30 per room it is practically far more difficult to ensure fresh air, and beyond that number it soon becomes impossible. Sad experience has proved that long rooms, like passages, with 100 or more persons sleeping in them, may become highly dangerous during epidemics, and absolutely pestilential if occupied by sick. The reason of course is that the direction which the foul air may take in the room depends on accidental circumstances, not under control, which may lead to its being accumulated at one end of the room, or over one group of beds. This danger may be incurred at any time with long rooms, even if there be no more than two rows of beds; but when other two rows are added, or, as in the case of the Dalhousie barracks, other four rows, a form of construction is introduced only to be kept healthy by the exercise of greater care than is ever likely to be bestowed on the subject, and by very large sacrifice of space per bed.

Defective as the barracks at home stations have been shown to be in some important points, they certainly possess one great advantage over those in India. The rooms rarely hold more than 10, 15, or 20 men. The windows (at least, in the infantry barracks) are generally on opposite sides; but where there are two rooms in the depth of the building, with openings through the partition walls, such barrack rooms are by no means so healthy, although they may have a thorough draught, simply because the construction enables four rows of beds to be placed between the opposite sides of the building. If an error in construction such as this, even with a small number of inmates, exercises an appreciable influence on health in this climate, it must, of course, be far more prejudicial

BARRACK CONSTRUCTION. in India, especially in rooms containing from a quarter to half a regiment.

The influence exerted on the health of troops by the large size and construction of barrack rooms in India has not passed unobserved. There is a general impression that great constructive improvements are required.

5645. Sir A. Tulloch states, as the result of his experience, that a very great advantage is likely to be obtained by having separate buildings each for a limited number of men, instead of their all being in one barrack; that they would be much more likely to be healthy in small buildings holding 10 men each; that there would be less risk of disturbance and of the spread of disease.

2906–8. Sir John Lawrence, while stating the great improvement recently made in barrack building, says that the only defect he ever saw is, that the barracks are too large, and contain too many men; that, instead of building a barrack for a whole company, it would be better to build it for a half or a quarter of a company. He considers the smaller barracks much safer in the event of an epidemic appearing, and that small barracks are better for the men, both morally and socially.

2380. Deputy Inspector-General Maclean gives the following testimony on this point:—

> Are you generally in favour of isolation, and of putting the soldiers in separate dwellings, or in smaller barracks?—I am of opinion that they ought to be all in separate buildings. I think that the system which now prevails in India of erecting costly palaces for troops is one of the most unfortunate mistakes that was ever made, because in the first place, the barracks are so costly that the Government grudges the space required for the men; and I am quite sure that if such barracks were built as Colonel Durand knows were erected at Moulmein, detached bungalows, well raised from the ground, and well ventilated with roof ventilation, the health of the troops would be enormously increased, and the Government would save an immense sum of money.

2385–6. He further states that the natives in India never live together in large dwellings; that epidemic diseases are very apt to run through large barracks; and that in barracks of two floors, the lower floor cannot be ventilated.

5490. Dr. Sutherland (who is a member of the Commission for improving Barracks and Hospitals), states that it is impossible to ventilate efficiently rooms with 100 or more men; and that quarter-company barracks, *i.e.*, separate

BARRACK CONSTRUCTION.

houses for 20 or 25 men, are about the limit to which we should go in this mode of construction in India.

Many of the newer barracks have double verandahs, a construction which has the twofold disadvantage of rendering the ventilation more difficult, and of enabling the inner verandah to be appropriated as extra sleeping space. The double verandah is at the same time an unnecessary cost.

One very important point as bearing on the healthiness of barrack construction, is the relative position of the beds with reference to openings through which the outer air comes in. In the ventilation of home barracks, it has been found necessary for the men's health and comfort that the air shall be insensibly diffused through the room without draughts upon the beds. In India, of course, a much freer ventilation can be borne than in colder climates. But the difference between the day and night temperature is often so great that an air-current which might be borne with impunity through the day, becomes at night a serious inconvenience, and may be a dangerous cause of disease. As already stated, in the Indian barracks the beds are placed between the doors, or, if in more than two rows, down the middle of the room; but the space between the doors is so narrow that the wind falls directly upon the side of the bed if the doors are open, and if the doors are shut the ventilation of course is shut out too. Deputy 681. Inspector-General Stewart states, that the space between the doors is generally seven feet, occupied by two beds, each three feet wide, and leaving only one foot between the beds, which, in India, is over-crowding; that the beds project more or less beyond the protection of the wall; that the men occupying them are liable to be injuriously exposed by night and day, and in all seasons, to strong direct currents of air; that in the rains and in the cold season, as well as in the hot months, this exposure may lead to serious results, and that it need not be matter of surprise that rheumatism, pulmonic affections, dysentery, and other serious and fatal diseases should prevail.

It must be obvious that barracks so constructed can never be healthy, and that the ventilation, to be efficient, must be independent of doors and windows, at least during the night.

One cardinal error in barrack construction which prevails throughout India, is placing the barrack rooms at or near the level of the ground. As already stated, the

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surface of the country is charged with malaria, the action of which extends to a greater or less height above the ground.

4400. Night fogs, which may be considered as indicating the presence of malaria, rise to a certain height above the ground, especially in Lower Bengal.

4402. Mr. Montgomery Martin attributes various native
4403. diseases partly to this cause. He says, further, that troops should sleep above the level of the fog; that all the lower stories of barracks or hospitals which he has examined in tropical regions are unhealthy; a result which is caused by a pestiferous gas rising from the earth in regions where vegetation and moisture exist in excess; but that this gas does not rise to any great height, and slowly commingles with the atmosphere.

2803. Mr. Julius Jeffreys corroborates this opinion. He says, that in India all kinds of exhalations are rendered visible by smoke or fog in cool mornings; that it is well known that the density of malaria is in some very high ratio inversely proportionate to the distance from the surface of the ground; that he never saw troops in India quartered above the ground; and that the evidence to his mind was quite conclusive that much disease arose from troops being housed on the ground level.

2181. Deputy Inspector-General Longmore instances the occurrence of these fogs at the very unhealthy station of Dinapore. The barracks are very little raised above the ground. He says that in the morning or after sunset, if there is not much air stirring, a dense vapour may be seen resting over the surface of the ground, while above
2182–3. this vapour or a little below it the air is clear. He states that, in his opinion, this vapour carries malaria with it, and that much of the disease at Dinapore might have been prevented by having a free circulation of air below the rooms.

The barracks, he says, are otherwise badly arranged in close squares.

1743. Major-General Goodwyn states, that he knows only of one instance (at Calcutta) in which the barracks are raised above the ground; and that he considers the
1781. absence of arcaded basements as a great fault; he thinks they should be raised at least 12 feet from the ground.

Raising the floors, with free passage of air underneath, is necessary not only to avoid malaria but to avoid damp in flat or low-lying districts, where there are small natural

BARRACK CONSTRUCTION.

Vide abstract of stational reports.

facilities for drainage. The stational returns show that the barracks throughout India have been constructed without reference to this primary condition of health. While it is a native habit to sleep only on upper floors, in order to avoid malaria, the European soldier, who is a much more susceptible subject, has all along slept at or near the level of the ground.

The usual mode of constructing floors has been to raise a plinth a foot or two in height, to fill up the space with earth or some other material, and to lay the floor upon it. The flooring consists of various materials, generally of stone, composition, tile, or brick, but sometimes of rammed earth, painted over periodically with a solution of cow-dung. 757. Referring to the condition of barrack floors, Colonel 4033. Campbell states, that if they are in good repair and perfectly smooth, they are always dry; but that if the surface of the plaster becomes broken, the floors absorb wet, and it remains. Dr. James Bird states, that the mud floors are 3460. most objectionable, that brick floors are better, but that a wooden floor is the best of all. Washing floors with cow-dung is a native practice, and is used to render the surface more durable and to prevent vermin. Flooring of this description should be forbidden.

The height to which the floors should be raised above the ground will depend on local circumstances. In low, flat, and damp districts, each barrack should consist of two floors, the upper one only to be used as a sleeping room, and the lower floor to be a covered place for exercise and amusement, as suggested by General Goodwyn. 1780. In more high and dry districts, four or five feet would be sufficient to raise the floor; and less would suffice at hill stations. The space should be arched to allow of the freest passage of air. Objections have been made to this construction, that filth or dead animals get into the space and create nuisance. But this can be easily prevented.

The best kind of flooring for India is, undoubtedly, that which absorbs the least moisture in cleansing. In this climate a good wooden floor is most wholesome, and there are a number of testimonies in its favour as being the best for India.

Stational reports.

The materials chiefly used in the construction of both barracks and hospitals, are burnt brick and mortar; in some instances, burnt bricks set in mud. Sun-dried bricks cemented by mortar or mud, are also used. In a few instances, the walls are of stone and lime, or stone set in

BARRACK CONSTRUCTION.

mud. Timber is sometimes used as a framing, and more recently iron. The roofs are generally of tile, or thatched, and sometimes tiled over the thatch. In some recently constructed barracks, the roofs are arched and terraced. Double walls or double roofs, having air passing up between them to keep down the temperature, have not been introduced in India. Thickness of wall and roof has been chiefly depended upon. The materials are stated to 1731, 1733. be well adapted to the climate, generally. But General Goodwyn states that the bricks are often of bad quality, and admit of great improvement in manufacture.

This is a matter which ought to be considered; for, as he justly observes, there is nothing more destructive to health than an imperfect brick building. Wherever the plaster peels off, the brick absorbs moisture, destroying the permanency of the barrack, injuring the accoutrements, and, above all, the men's health.

710–13. One point in the construction of cavalry barracks is much insisted upon by Deputy Inspector-General Stewart, as injurious to ventilation. There are no saddlery rooms belonging to the barracks, and the men carry their saddles saturated with the horse's perspiration into their sleeping room, where they are kept. The practice is both unnecessary and hurtful. Every cavalry barrack should have a dry, well-ventilated saddlery room attached.

VENTILATION OF BARRACKS.

BARRACK VENTILATION.

The means of ventilation chiefly trusted to in Indian barracks, are doors and windows.

There is very little glass used, and the windows, where they exist, are either venetian, or they consist merely of openings, with solid wooden shutters, which, when closed on account of weather, leave barrack and hospital in darkness. In many cases, the doors are also venetianed.

Many of the hut barracks have louvres in the roof for ventilation. And in barracks with a central raised aisle, there are clerestory windows above the arches, or at the ends, together with ventilators in the ridge.

More attention has been lately paid to this important subject, and many of the newer barracks are better ventilated.

But there is sufficient evidence to show that considerable improvement in this respect is still required.

165. Sir R. Martin informs us that there has been the same want of strict attention to ventilation in India, as hitherto

BARRACK VENTILATION.

in England. Colonel Campbell states that the old class of barracks are deficient in upper ventilation, that such openings as exist are, generally speaking, not sufficient for the purpose; that there is frequently much closeness during the night and in the morning. The arrangements in the newer barracks he considers better. 4022–6.

Major-General Goodwyn states that the roof ventilation is at present very spare and scanty. 1760.

The ventilation, such as it is, is interfered with by the soldiers; a fact which, of itself, would lead us to suspect that the men are exposed to draughts. 2643.

On this subject Brigadier-General Russell states that the men do not object to ventilation, but that they object to any air coming upon their persons. When this is not attended to, the men get chilled and suffer from diarrhœa. The danger of draughts at night is perfectly well known to natives, for Dr. Julius Jeffreys states that, in watching a garden at night, the native places a mat to windward of his bed to cut off the immediate current from his body. He says, this is a matter of really prime importance; for it will often just make the difference whether a man escapes or not an attack of rheumatism or intermittent fever. 3728–9. 2840.

In some barracks and hospitals of the Bombay Presidency, an attempt was made to introduce fresh air by air channels under the floor, opening by gratings into the rooms. Refuse of various kinds was thrown down the gratings, and these air channels became the channels for foul air. This is a method of ventilation which ought never to be adopted. 1171.

The requirements of good barrack ventilation, in India, are summed up by Lieutenant-Colonel Gall, as follows:— 907.

The ventilation should not depend on doors and windows; it should not cause a thorough draught, to which the men are exposed; there should be sufficient space between door and door, and window and window, to allow the men not to be exposed to draughts; and there should be room for a table between every two beds.

The stational reports adduce instances of what may be considered as structural defects in ventilating arrangements.

Sometimes, *e.g.*, the rain beats through the ventilators. Or the amount of ventilation which is sufficient in one state of the wind becomes too much or too little in other states. Or during dust storms, the dust is driven in. We

BARRACK VENTILATION.

allude to these defects, because often on such small matters the whole question of fresh air to a barrack or hospital depends. The two first admit of remedy, but it is questionable whether anything short of closing every crevice would keep out dust during a real dust storm, for the short time during which it lasts.

3704. The following example of an efficient method of ventilation adopted in an unhealthy barrack at Secunderabad, during an alteration in the barrack, and the result on health, is given by Brigadier-General Russell:—

> "The opportunity was taken to raise the walls three feet, and to put on what was termed a Bengal roof, by which a current of air was admitted all round, and wire gauze was placed inside and outside the ventilators, beyond the reach of the men. After this was done no serious case of dysentery, the scourge of Secunderabad, occurred among the men quartered in this building, and the medical officer, who visited it before morning gunfire, found the atmosphere as pure and sweet as in his own bedroom, which he had just left, while it was very offensive in the other portions of the barracks. This dysentery, I therefore conclude, arose more from the construction, overcrowding, and defective ventilation of the barracks than from their site."

In a climate such as that of India it is impossible to estimate the amount of fresh air required to keep either a barrack-room or hospital ward in a good sanitary state. In England 1,200 cubic feet in rooms, and about three times that amount in sick wards, per man per hour, are required. At certain seasons every breath of air becomes of importance, and there is no test, except that of freshness, to be relied on as indicating the efficiency or inefficiency of the ventilation. Ridge ventilation, together with a free admission of fresh air under the eaves, on some such principle as that adopted at Secunderabad, affords the best solution of the problem for India.

SPACE PER MAN IN BARRACKS.

BARRACK SPACE.

The greater proportion of European troops in India have, according to regulation, upwards of 1,000 cubic feet per man. In a number of stations the average amount exceeds this, and rises to 1,200, 1,400, and in some instances to 1,600 and 1,700 cubic feet. The average at Secunderabad is 1,000. In about 12 stations the space is less, and varies from 480 to 900. The largest amount at any station is at Rangoon, where the average is 2,200 to each European. The regulation amount on home stations is now 600 cubic feet per man, and at first sight the advantage is very much in favour of the Indian stations. A large cubic space, however, does not necessarily imply absence of overcrowding, for two reasons:— BARRACK SPACE.

1. The space may be above the head.
2. The beds may be too near to each other.

Both of these unfavourable conditions exist in Indian barracks; *e.g.*, on account of the great height in many of the barracks, the superficial area per bed by no means corresponds with the cubic contents. The average at the majority of stations is between 60 and 70 square feet; in not a few instances it falls below 50. At Secunderabad the men with 1,000 cubic feet have only 40 to 60 square feet. At a few stations the amount is from 70 to 100 square feet, the largest amounts being at Rangoon, where each bed has 120 square feet, and in the bomb proof barracks, Fort William, where the surface area is 140 square feet per bed. But the report states that even with this amount of superficial area, one half the number of men would be too many.

From the construction of the barracks, the beds, as already stated, are too close to each other, every pair having only a foot between them, while at the same time there is a large unoccupied floor surface. Practically, therefore, nearly every barrack-room is overcrowded.

The regulation amount of space by no means represents the degree of crowding which may take place in a barrack. Usually the number of men is the number which may happen to be at the station, be that number more or less; and it has been stated that the lofty barracks recently constructed have been expressly intended to prevent a larger number of men being put into them than the floor surface would accommodate. This is an error. With the intention of preventing overcrowding, it really introduces what in India is the worst form of overcrowding, viz., bringing the beds too close together.

Major-General Cotton advocates a much better course. 2026. He says that, in point of fact, it would be well to have the barracks so constructed that, in case of emergency, they might be capable of holding more men than under ordinary circumstances. He advocates lower rooms, and more attention to ventilation.

Deputy Inspector-General Maclean states that over- 2352. crowding and bad ventilation have been the master sins of the old system.

BARRACK SPACE.

5508. As regards the amount of cubic space and superficial area required for health, Dr. Sutherland states that this will depend on the position of the barrack, that on high ground, with a free circulation of air, 1,000 cubic feet and 80 square feet per man are enough; but that in low, imperfectly ventilated positions, it would be necessary to raise the amount to 1,500 cubic feet and 100 square feet per man.

MEANS OF COOLING AIR IN BARRACK ROOMS AND HOSPITALS.

COOLING OF BARRACKS.

Dr. Dempster's note, p. 468.

The usual means of cooling the air, and obtaining a freer movement of it, in barrack rooms and sick wards is by punkahs suspended from the roof and pulled by natives. This, which is an Indian practice, appears to answer, except at the hottest stations, where other means are used. These consist generally of frames filled with mats of kuskus grass fitted into certain of the doors or windows, and kept constantly watered by natives. When the doors and windows are all provided with these "tatties," and the only air which enters the room is that which must pass through the tatties, a considerable reduction of temperature takes place, but it frequently happens that doors are left open, and the cooling effect is reduced.

At some very hot stations "thermantidotes" are used. These are merely a copy of the ordinary winnowing machine, in which the air entering to supply the fan is made to pass through a wetted mat. They are said to answer their object as in hospitals.

1320. Other two plans have been brought before us for cooling the air. One of these by Captain Moorsom is merely a set of tatties moved by machinery and kept moist by water. It is intended to be more constant and efficient, and at the same time more economical, than the present system.

5662. Another method will be found described in the evidence of Mr. Siebe. It is a machine for making ice by steam power, and might be used also for cooling water or air, where the cost was no great object, as in hospitals.

ABLUTION AND BATH ACCOMMODATION.

ABLUTION AND BATHS.

At home stations ablution rooms are a modern concession to cleanliness, and it is only now that the extent of accommodation provided is becoming sufficient for the soldier's wants. In India, where the means of cleanliness require to be so much more abundant and accessible, they are deficient almost everywhere. At the large station of Peshawur, where there were between 1,600 and 1,700 European troops, there were no ablution rooms in August 1860. At another large station, Deesa, a washing room is attached to each barrack, but there are no conveniences for washing in it. The usual arrangement is to have stone benches along the wall; water is carried by bheesties, and iron basins are used for washing, as at home. None of the ablution rooms are drained. The foul water is simply conveyed to a cesspit, from which it is carried away by hand or allowed to sink into the ground. At some of the larger stations fresh water is conveyed to a cistern, from which it is distributed to the basins by taps. At many stations the ablution rooms are dark and damp; and, with a few exceptions, the ablution accommodation admits of great improvement. ABLUTION AND BATHS. *Vide* abstract of Stational reports.

Deputy Inspector-General Stewart states that the means of personal ablution at all stations are more or less deficient; that in some barracks they can scarcely be said to exist, and that the rooms are dark, confined, and inconvenient even for washing the hands and face; that the men do as they best can, and wash themselves perhaps in the open verandah, or in a small room at the end of it. 761–2–3

This is confirmed by Dr. Bird, and by Colonel Greathed, who state that the ablution rooms in barracks are generally imperfect. 3507. 3107.

At many stations there is more or less bath accommodation. Generally it consists of a plunge bath. In some cases baths of a smaller size are used. There is no bath for the large garrison of Fort William, where baths are urgently required.

Colonel Greathed says that the bath accommodation is sufficient for perhaps two companies, bathing every second day, although it is considered advisable that there should be a bathing parade in India every day during the hot season. The objection to this is the cost of the water-supply, which has to be drawn and carried by men and bullocks. It is indeed the same objection that would exist at home if water had to be provided to any extent as it is in India. But it is found possible to supply extensive bathing establishments with water by improving the method; and hence the present system of Indian 3117. 3119.

ABLUTION AND BATHS.

water-supply is directly opposed to keeping up a proper system of ablution for cleanliness and health.

It is obvious that the ablution and bath accommodation requires to be placed on a better footing, and that this cannot be done without a better system of water-supply. In situations where the water-supply is limited, shower baths on a large scale might be introduced with advantage.

COOK-HOUSES.

COOK-HOUSES.

Vide abstract of Stational reports.

The means of barrack cooking are of the simplest description. They usually consist of a small detached room or shed, without any chimney, and insufficiently lighted. Along the walls there are low platforms of masonry, with square holes to hold the fire. There is neither water-supply nor drainage. All the water is brought by water-carriers, and the refuse water is either allowed to escape as it best can, or it runs into a cesspit, and is removed by hand labour. The cooking utensils are very simple; but through the ingenuity of the native cooks almost every variety of dish can be prepared. The men like the cooking, but experienced medical officers do not consider it always wholesome. There is a large consumption of fuel, the smoke from which fills the kitchen and blackens its walls. Recently improvements have been introduced in the cook-houses of Fort St. George, Madras, by an army medical officer, who has adapted a set of boilers and oven on Captain Grant's plan, of which it is a modification. The food is said to be better cooked, and at less expense, both for fuel and attendance.

However imperfect the Indian cooking may be, it admits of great variety. And though modern improvements need to be introduced, yet it is by no means in the rude state in which home barrack cooking was found in 1858.

LATRINES AND URINALS.

LATRINES, &c.

Abstract of Stational reports.

These conveniences are usually placed in outbuildings at a short distance from barracks, and sometimes connected with them by covered passages for protection against sun and rain. They vary in construction at different stations. Those belonging to the older barracks are cesspits cleansed from the outside. In more recently constructed barracks metal pans have been introduced to

Latrines, &c.

facilitate the operation of removal. There is no drainage of any kind, and the arrangements altogether are very offensive. The only object attained is rapid removal of excreta to be buried or otherwise disposed of at a distance. In every other respect the latrines admit of great improvement.

Drainage, and the removal of excreta by water, is now universally considered to be the most economical and least injurious method of disposing of them ; but there is some doubt whether these improvements would be applicable to all Indian stations. In certain low, flat districts, where there is little fall for drainage, this might probably be the case ; but there are many stations in which drainage might be carried to an available outlet, and iron water latrines and urinals, properly supplied with water introduced.

Many of the buildings require light and ventilation, and none of the latrines have the recent improvements of divisions and doors which have been introduced of late years at home.

Wherever cesspits exist they should be abolished, and movable vessels or water latrines substituted for them.

Officers' Quarters.

Officers' Quarters.

Officers are generally lodged in detached bungalows, situated within compounds. Their sanitary condition is described in the stational reports as being good. But at some stations complaint is made that sufficiently good accommodation cannot be rented, because it does not exist. The great advantage, as regards health, possessed by officers is living in detached buildings, with free external ventilation. But their quarters partake of the general sanitary disadvantages of the station as to drainage, water supply, &c.

Quarters for Married Non-commissioned Officers and Soldiers.

Married Quarters.

Abstract of Stational reports.

Great improvement has been made in India of late years in providing this class of accommodation. It usually consists of separate huts or bungalows, of two or three rooms, built in the patchery, a court belonging to the barrack. In a few instances there are barracks for the purpose. In about 20 per cent. of the stations no separate quarters have yet been provided; and married people

MARRIED QUARTERS.

are lodged in barrack rooms divided by mats. There are two or three instances in which married people occupy the same rooms as single men, separated from them by mats. At two-thirds of the stations the married accommodation is said to be sufficient. In some of these cases there are from 80 to 120 separate married quarters. At about one-seventh of the stations where married accommodation has been provided, it is said to be insufficient; and at two or three stations it is described as bad.

The general sanitary condition of the married quarters partakes of that of the station. But the men living in patcheries with their families are much more healthy than men living in barracks.

Occasionally, from want of care, considerable overcrowding takes place in these quarters; and in one instance at least it was attended with frightful results. 2172-80. This occurred at Dum Dum, where a large number of women and children were lodged together in barrack rooms, without due care having been exercised as to the amount of space, or ventilation, or as to other sanitary arrangements.

There was an average monthly strength of 554 women, among whom there occurred 64 deaths in 5 months; and there was an average monthly strength of 770 children, out of whom died 166 in the same five months.

The annual ratio of mortality among the women would accordingly have been 276 per 1,000, and among the children 516 per 1,000; the usual proportions for Bengal being, deaths per 1,000, women, 44; children, 84.

The diseases of which so many perished were, dysentery, fever, and cholera. And the causes were intemperance, immorality, reckless exposure, unwholesome food, want of cleanliness, personal and general, and a polluted atmosphere.

2218-19. The effluvia from the privies were perceptible in the barrack rooms.

This calamity may have been exceptional; but it clearly shows the class of causes which exert the most destructive influence on European constitutions in India; children being there, as elsewhere, the most delicate tests of sanitary condition. The experience admits of application to all barracks where there are European soldiers; and it gives an insight into the causes of high mortality of children in these climates.

TENTS.

TENTS.

Stational reports.

Tents for camp or field service are of various forms and dimensions. Some are square, others are oblong or oval formed, some are circular, and others have a pyramidal section. They have some one, others two poles; and they vary in length from 11 to $22\frac{1}{2}$ feet, in breadth from 10 to 14 feet, and in height from $8\frac{1}{2}$ feet to 13 feet, within the inner lining. They consist of three or more layers of cloth, according to its quality, the inner layer being generally of a blue colour.

These tents accommodate a greater or less number of men, 14, 16, or 22 men, according to the arm of the service which has them in use. Their cubic contents vary from 935 to 2,835 feet, the superficial area of the floor varies from $9\frac{1}{6}$ feet to $24\frac{1}{2}$ feet per man, and the space per man varies from 77 to 220 cubic feet. The double poled hospital tents are larger and better than the others. They afford 26 square feet, and 236 cubic feet per man for 12 men.

None of the tents are ventilated, except by opening the doors and raising the walls; but this of itself is not sufficient. Ventilation round the poles at the top is indispensable, to keep the air in the tent sufficiently pure, and the spaces between the different layers of cloth should also be ventilated, to afford a means of escape for the air heated by the sun's rays. Abundant means of admitting fresh air, and allowing of the escape of foul and heated air above, can alone compensate in any degree for the overcrowding to which all tents are liable.

Objections have been made before us to the whole structure of the present Indian tent, by Mr. Jeffreys, who proposes a totally distinct form, as being much cooler and more healthy, and affording a larger space per man. We 2831. refer to his evidence for a description of the tent he proposes.

DIET.

DIET.

At every station in India the British soldier is supplied with a full ration, including the following constituents:—

Meat, 1 lb.	Rice, 4 oz.	Coffee, $1\frac{3}{7}$ oz.
Bread, 1 lb.	Sugar, $2\frac{1}{2}$ oz.	Salt, 1 oz.
Vegetables, 1 lb.	Tea, $\frac{5}{7}$ oz. or	Firewood, 3 lbs.

The foundation of the ration is beef and bread. Mutton is issued in lieu of beef twice a week, when procurable. The pound of vegetables consists of potatoes, when pro-

DIET. curable, carrots, onions, pumpkins, &c. There are complaints that the issue of mutton is too small, and that vegetables cannot always be procured in sufficient quantity. But generally the ration is considered good. The stoppage is about fivepence (3 annas, 4 pie). The cook generally supplies some trifling articles in addition, such as meat for breakfast, milk, and some times butter, &c., for an anna a day. The large bone is separated from the meat before it is weighed for issue by the Commissariat.

The captains engage the cooks, just as they would engage washermen, and the charge for cooking is 10 to 12 annas per month. Not unfrequently the men, if they have money, will buy bacon and pork, badly and filthily
2945. fed; for the bazaar pigs are the bazaar scavengers. And thus, whatever care may be exercised by Government in providing healthy food, the men and the cooks may add meat which is quite the reverse. In addition to all this, the soldier may add 1 quart malt liquor, or 2 drams spirit, per diem.

The first thing that occurs in considering this system of diet is, that it would be amply sufficient for the sustenance of men engaged in out-door toil in a cold climate. Indeed, we very much question whether labouring men at home consume so large an amount of nitrogenous and carboniferous food at any ordinary time. In India it would be enough to supply the requirements of the hardest
3521. work the climate would admit of. But, at the same time, there is a certain exhaustion produced by the climate and the manner in which the soldier passes his time, which makes the present ration apparently no more than sufficient.

The soldier has three meals a day: breakfast at seven or eight in the morning, consisting of tea or coffee, with bread and often meat; dinner at one p.m.; tea about five, sometimes with meat too. The dinner is therefore eaten just before the hottest part of the day; and all the meals are crowded into nine or ten hours of inaction.

In considering the influence of this on health, we must be guided by other facts.

2942. In the first place, the natives who are accustomed to the climate eat very little animal food, particularly in hot weather. This native habit, which is the result of a natural instinct, is in strict conformity with physiological law. Besides providing for the waste of the body by exertion, part of the food goes to supply animal heat.

But where there is little or no exertion, and where the climate is hot at the same time, the amount of food necessary for health is much less than it would be in a cold country under hard work. Some useful experience on the effect of overfeeding in tropical climates has been laid before us by Staff Surgeon Dr. Rennie, for several years in medical charge of convicts in Western Australia. In his evidence, and in a note appended to it, he states that over-feeding and the too free use of animal diet produced much disease, including dysentery, among the convicts; that by reducing the amount of both, improved health followed, and that a further reduction in the scale of diet, with other improved sanitary conditions, led to a very remarkable improvement in the general health of the prisoners. He states it as his opinion that what are familiarly known as "the diseases of tropical climates," are in reality diseases resulting from habits and circumstances of life generally unsuited to tropical climates, and that the relation which food (including alcoholic stimulants) bears to temperature is seriously overlooked in the dieting of bodies of men in the public service. DIET. 870.

The soldier in India has not sufficient occupation to keep him in health; and under such a system of dieting, as he at present undergoes, he must suffer, more or less. By overloading the system with useless elements, the digestive and biliary functions become disturbed, and a predisposition to disease is induced. For this state of things, the soldier should either have work or exercise provided, sufficient for his diet; or his diet should be made to accord better with his sedentary habits. No general rule can be laid down in this matter, applicable to all circumstances. But one thing is quite clear, that the soldier should have more exercise, and that the same diet which may be consumed in the cold season with safety cannot be the most suitable for heat. Dr. Dempster tells us that it is certain that the majority of the recruits from Ireland Page 466.
and Scotland eat in the hot weather in India many times the bulk of animal food ever consumed in their native country while working hardest in the coldest season of the year. And that the same quantity of animal food and stimulating drinks taken with advantage by a working man in a cold moist climate is not only unnecessary, but positively injurious to the almost idle European soldier in the burning plains of Hindostan. So little is the importance of the difference of climate recognized that the soldier eats

Diet. animal food twice or even thrice a day all the year round.
2943. Sir John Lawrence says that he does not believe the
officer does so, and that if he does, he gets sick too.
The evidence before us goes to prove that the present
dietary of the soldier considered with reference to the
amount of work he has to do is injurious to his health,
2946. and we concur entirely in the opinion of Sir John Lawrence
that Government might try to induce the men, by
varying the ration, with reference to hot and cold weather,
to use more vegetable diet and fruit, and less animal
food.

The regimental medical officer is indeed charged, by the new medical regulations, with the duty of making such representations on this subject to his commanding officer as he may deem necessary for the health of the troops, so that the principle of change is admitted.

Dress.

Dress. Much interesting and valuable information on the subject
of the soldier's dress in India will be found in the
stational reports and in the evidence, and several important
suggestions for improving some of its details have been
2860. laid before us, particularly by Mr. Julius Jeffreys, who
has paid much attention to the subject.

The dress of late years has undergone great and beneficial changes, and is now much better adapted to the climate, seasons, and duties, than it was in former times.

3238. The soldier now wears habitually a khakee (dust-coloured
cotton) tunic and trousers, and a helmet made
of wicker work. The collar is made to fasten with a hook
and eye, and no stock is worn except in cold weather.

80–83. As regards under-clothing, the evidence is in favour of
wearing light flannel next the skin, especially at stations
subject to sudden changes of temperature, and under
exposure.

Sir Ranald Martin considers that the evaporation from
the surface of the body is so great in India that a slow
conducting medium next the skin is absolutely necessary,
and that dysentery and liver disease are frequently produced
by chills. Flannel moderates the evaporation from
the surface of the body, apparently without heating it, for
2886. Mr. Jeffreys states that he has repeatedly ascertained the
temperature of the skin in hot and dry weather to be much
lower under flannel with a cotton dress over it, than under
cotton alone. The value of flannel in preserving health

has been long known to army officers, and the main objection to its universal introduction is the difficulty of washing; but on the other hand this objection does not apply with much force to its use in India where labour is so cheap. DRESS.

The present head-dress is formed for the special purpose of protecting the head from the sun's rays, which it does with considerable efficiency, but several ingenious improvements in it have been laid before us by Mr. Jeffreys, 2860–2874. which are worthy of examination. He proposes to make the outer shell of the helmet double, with a ventilated space between the layers, and within the shell there is a lining to fit tight to the head, leaving another ventilated space between the inner surface of the shell and the wearer's head.

The object of the contrivance is to ensure the passage upwards of two distinct currents of heated air between the outer shell of the helmet and the head. In order to diminish the power of the outer shell to absorb the sun's rays, the inventor proposes to cover it with a thin highly-polished metallic surface.

In proof of the great importance of giving every attention to the subject, it is stated that between the years 2883. 1830-45 the annual mortality among troops in Bengal was nearly 30 per 10,000 from apoplexy alone; that in particular instances the mortality from this disease has been as high as 500 per 10,000, while the deaths from the same disease in England were less than 2 in 10,000.

Mr. Jeffreys also mentions that excessive heat on the 2881. brain produces moral depression, even among the best troops in the service. Sir R. Martin concurs in this opinion.

Our attention has been called to one other matter of dress,—the boots, which, as at present issued to the soldier, do not fit well. They are made at home on a very few models and sizes, and when sent out to India are found in very many cases not to be wearable. Colonel 3243, 3244. Greathed states that in his regiment the men never used them, and that they were taken to the shoemaker's shop and made over again at a certain cost.

In the report from Ahmednuggur it is stated that the present system of serving out boots of similar shape to men with differently-shaped feet "cannot be too much reprehended," and that a better system, although somewhat more troublesome and costly, would be amply

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repaid by increased efficiency. The reporters suggest that "upper leathers" and soles should be sent out to India, all of the largest size, and made up to fit the men by shoemakers attached to each company.

Either this course should be followed or a larger variety of sizes provided. The simple fact mentioned by Colonel Greathed is sufficient to prove that a change of system is required. Foot-lameness from badly fitting boots admits of no excuse. Of all causes of inefficiency in an army it is the most unjustifiable.

INTEMPERANCE.

NTEMPERANCE.

Stational reports.

According to existing regulations, every soldier has a right to purchase at his regimental canteen two drams of spirits of good quality, generally rum or arrack, supplied by the Commissariat; or he may substitute malt liquor, wholly or partially, for spirit. The quantity of malt liquor issued in lieu of spirit varies in different regiments, but generally it appears to be a quart in lieu of a dram. Formerly spirit used to be issued as part of the ration, and it could be obtained early in the morning; but of late years this practice has been almost, if not altogether, discontinued. No intoxicating drink is issued before dinner, but every soldier has a right to purchase the quantities of spirits or beer stated above. Beer can be removed from the canteen for dinner, but spirits must always be drunk at the bar; and in order to prevent a double issue, a non-commissioned officer attends in the canteen and registers the men's names who have received their allowance. In some regiments no spirit is allowed to be issued until evening.

Two drams of spirit are equal to the twentieth part of a gallon, and hence each soldier who avails himself of his privilege of dram-drinking to the fullest extent, will consume 18¼ gallons of raw spirit per annum; but most men content themselves with one dram and an equivalent of malt liquor.

Several very serious questions arise out of this practice of continual dram-drinking, as it affects the health and efficiency of the army in India. In colder climates it is known that there is scarcely a habit to which men are addicted which so surely and steadily undermines their health and predisposes them to organic diseases as the daily use of spirituous liquors. It disorders the digestive functions, irritates the nervous system, occasions struc-

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tural disease of the liver, brain, and bloodvessels, and is a most potent predisposing cause of cholera and other epidemic diseases. A simple statement of these well-known effects of continued tippling is sufficient to show that of all habits it is about the last which should be indulged in or encouraged in such a climate as that of India; for the diseases which it is observed to cause in this country are diseases from which the soldier suffers severely in India. Liver disease, delirium tremens, sunstroke, and apoplexy, as well as cholera, prevail to a large extent all over India, besides a number of diseases which are indirectly traceable to intemperate habits. A striking illustration of the evil results of even casual acts of intemperance is given by Dr. Bird, who mentions that on one occasion a great mortality took place in the horse artillery. Apoplectic seizures, cerebral symptoms, and fever struck them down. "We marched," he says, 3581–2.
"through a great number of date-trees, where the men "pulled down the pots that are attached to the trees; "they could pull them down, and drink the contents." "Toddy and the sun" killed them; but the deaths were laid to the account of the latter.* Intemperate habits are also the most fruitful causes of indiscipline and crime.

Abstracts of Stational reports.

At some stations the proportion of cases received into hospital, directly or indirectly the result of intemperance, appears to be about a tenth part of the total admissions from all diseases; and there is a remarkable concurrence of testimony in the reports of the different stations as to the injury to health generally caused by the use of spirits. Some medical officers go even further, and object to the use of malt liquor in such a climate, and propose to sub-

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* Referring to the effects of drinking ardent spirits, Sir Charles "Napier says :—"Drinking does not give the fever, but it so inflames "the liver and brain, that the fever takes too firm a grasp to be got rid "of. Why! their ration is *two drams* a day, and *eight* of these drams "make a *quart bottle!* so the sober soldier swallows *one-fourth of a* "*bottle* of raw spirits every day! You and I know them too well to "doubt that the other three-fourths go down after the first. Dr. Robin-"son, of the 13th, a clever man, supposed to know India better than most "others, tells me that at Jellallabad, where no liquor could be had, "where they could get only water, he had not a sick man the whole "time! The great disease *with officers and men is drink, but the* "*soldiers drink worse liquor, namely, arrack, which is made with any-*"*thing and everything but rice.* Rice, the wholesomest of all Indian "produce, is sadly belied. *This arrack* is made chiefly of *bhang*, a "liquor drawn from the date-tree, not by distillation, but incision in "the bark."—Napier's Conquest of Sinde, p. 530.

INTEMPERANCE. stitute for it light wines, ginger beer, tea, coffee, &c., for the reasons stated by Dr. James Bird that "it is a physiological principle that any hydrocarbonized drinks, "whether beer or spirits, are more objectionable to men "going to a warm climate" than the less stimulating drinks we have enumerated. 3546.

The same evil results of intemperance have been traced among the civil European population. Dr. John MacLennan states, that in one hospital at Bombay the amount of disease admitted from intemperance was "something "appalling;" that nearly one tenth part of all the admissions during a period of 10 years were from delirium tremens and ebrietas; that, with the sole exception of fever, the number of admissions was larger than from any other disease; and that, as to deaths, "alcohol destroyed more "than either fever, hepatitis, or diarrhœa, and nearly as "many as cholera." About a third part of the victims of intemperance were soldiers and pensioners. 1229.

We are glad to say that in some regiments habits of temperance have been introduced, and with marked benefit to health.

Page 466. Mr. Dempster instances the case of the 2nd troop, 1st brigade, horse artillery, in which a temperance movement was introduced at Meerut, and only 20 men drew the spirit ration, the remainder either drinking moderately of malt liquor or abstaining altogether. He states the effect to have been excellent, and that he "had never before "seen European troops in India in so good a condition "in all respects;" that when the troop arrived at Meerut from Loodiana it had 50 per cent. actually in hospital, and that after a four years' residence in Meerut, under the temperance system, it marched to Sealkote "with a "clean bill of health, no death having occurred among "the men for a period of two years." It is, however, but fair to state that Meerut is a comparatively healthy station.

The 26th Cameronians, while under the command of the late Colonel Oglander, is cited by Dr. Maclean as a temperance regiment, whose health was "admirable" up to the time of their landing at Chusan, where they were destroyed by bad food and bad locality, until at the end of two months they could not muster 20 men. While they were at Fort William they had only about a third of the sickness under temperance which they suffered from under dram-drinking. They landed in China 900 2390, 2391. Appendix 2nd, to Kurrachee Report, vol. 2.

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strong, and there was not a single man in the regiment, except the old soldiers, who drew his spirit ration.

2390. Dr. Maclean also mentions a remarkable illustration of the beneficial effect of temperance in the 84th regiment, under the command of Colonel Russell, while it was stationed at Secunderabad, which has been hitherto one of the most unhealthy spots in India. The Irish Roman Catholic priests in the regiment promoted the temperance movement so effectually that there was scarcely a man in the regiment who drew the spirit ration; and he says, "as might be expected, it was one "of the healthiest regiments I ever saw in Secun-"derabad."

1355, 1356. Another similar fact is mentioned by Dr. Colvin Smith as having occurred at this station. He says that the 3rd Madras European regiment was remarkably healthy at Secunderabad in 1856; and when his attention is called to the fact that this healthiness is an exception to the rule, he states that it is to be accounted for in this way, "that they got rid of all the grog shops about the lines, "and that improved the health of the regiment im-"mensely."

The whole tenor of the evidence, then, goes to prove that the consumption of ardent spirits by the troops is a very potent cause of disease in India, and that much benefit to the efficiency of the army would accrue from discontinuing its use, if it were practicable to do so. *Vide* also Stational reports.

It is upon the practicability of effecting this great reform that the whole question turns.

The use of spirits habitually is an acquired taste, which after a time becomes confirmed. The habit exists throughout the British army, and is carried with it to every station at which it serves, whatever may be the climate or its dangers. It is this depraved taste which lies at the root of the whole matter, and which renders it so difficult to deal with the question.

Throughout the army, drunkenness is punished as an offence, and at all home stations the sale of spirits is forbidden in the canteens. So far, the habit meets with discouragement.

The introduction of libraries, reading rooms, schools, good conduct badges, amusements of various kinds, and savings' banks are encouragements to temperance which have been introduced of late years.

INTEMPERANCE. It is considered to be unnecessary at home stations to permit the sale of ardent spirits in canteens, because no danger can accrue from the prohibition, while, at the same time, their use is, to a certain extent, discouraged.

But at most foreign stations, and throughout the whole of India, it has been considered advisable to permit the sale of ardent spirits, under restrictions as to quality and amount, in all canteens; because bad, adulterated, and, in some cases, poisonous spirits only could be otherwise obtained by the soldier.

The permissive, authorized sale of spirits, the use of which by the troops we have shown to be an indirect cause of a large amount of disease and mortality, thus becomes a direct encouragement to intemperance and disease, while its avowed object is to prevent disease by supplying men with a less injurious spirit than they could otherwise obtain.

There are also certain financial advantages derived from this monopoly of sale, which are thus described by Colonel Greathed:—

"3185. You say that the soldier derives a certain pecuniary benefit from the canteen fund, will you explain to the Commissioners how that arises?—It is from the enhanced price at which the spirits are sold,—8 annas or 1*s*. is imposed upon every gallon of spirits, and that in a very short time creates a fund which supplies the wants of the soldier without any expense to himself; for instance, the canteen fund, under the regulations of the Government, pays for the cap covers of the men, which are very necessary, and a constant expense; it also pays for all his amusements,—the fives court and the theatre, the skittle ground and the gardens, and in fact any reasonable request which the commanding officer makes is always granted.

"3186. When we speak of the Government providing soldiers with a fives court, or other means of amusement, we mean that, in point of fact, the soldier provides these for himself by the tax which is levied on spirits, and which is levied on spirits exclusively?—The fives courts are always parts of the barracks; the theatres are certainly maintained by the soldiers, or by the regiment; the men subscribe to them. The theatre at Jullundur was bought; we paid 300*l*. for it, and that money was paid out of the canteen fund entirely; that the Government did not give at all: and, in fact, everything connected with the amusements and comfort of the men is paid for out of the canteen fund."

3190. In the appropriation of this fund, Colonel Greathed states that the fund accumulates in "a wonderful way," and that the great difficulty is to keep it down. After 3,000 rupees are accumulated, the Government may lay its hands on the fund; and it is the object of the officer commanding the regiment to spend it as quickly as he can. INTEMPERANCE.

It appears then that there is a tax on spirits which is applied in India to purposes and objects which are met in a totally different way at home, and that there is a direct pecuniary interest in the soldier consuming spirits up to the full extent of the regulation allowance. There is, as it were, a tacit encouragement for the soldier to drink that which is admitted to be injurious to health, in order that he may be benefited in other ways, which may be conducive to health. So long as this pecuniary interest is recognized, it will be impossible to deal effectually with the evil. Government in India should cease to have anything to do with such a source of revenue, in the same manner as it has done at home; and whatever is necessary for the soldier's health and recreation should be otherwise provided for.

Colonel Greathed says, "I cannot defend it. Let the "Government give the money, and the thing might be "done. It is a question of money." 3194.

As regards the danger of bad or adulterated spirits being obtained by the men, there is an all but universal belief that if the supply at the canteen were discontinued, the men would be injured by drinking bazaar spirits.

Distillation appears to be carried on to a large extent all over India, and in every bazaar there are places where spirits of some kind can be openly bought or otherwise obtained at a very small price. This spirit is stated to be very unwholesome, and often adulterated with poisonous drugs, such as stramonium, &c., to increase its intoxicating power. It is not very strong, but it is so cheap that a man may intoxicate himself for three halfpence, or less. It is allowed to be sold in the bazaars, but not to soldiers, under severe penalties both as regards the vender and the man himself.

One of the most difficult and important duties of the bazaar magistrate is to keep the soldiers from obtaining this bad cheap liquor, which he does manage to procure notwithstanding the facilities afforded by the canteen and the penalties to which he subjects himself.

Sir R. Martin says, "restrictions are always attempted, 65.
"but then the evil of open cantonments throughout
"India, is the difficulty of maintaining a proper system
"of medical police, especially in regard to the use of the
"pernicious bazaar spirits." Testimony to the same effect

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is given by other witnesses, and, indeed, the difficulty of preventing the sale of bazaar spirits to soldiers, is the only reason alleged in the stational returns for the continuance of the present canteen system. From nearly every station, and from all classes of officers, there is the same expression of opinion, that the use of spirits by the troops is neither conducive to health nor discipline, and that it ought to be abolished were it possible to prevent the consumption of bazaar spirits.

Notwithstanding every effort, it is to be feared that the cheap spirit will always cope successfully with the dear spirit; and the whole evidence leaves it very doubtful whether, considering the encouragement given to men to drink spirits in the canteen, confirming their bad habits, and the cheapness of the bazaar spirit which they manage to procure, the present canteen system is of any use in protecting the soldier's health.

Stational reports.

The testimony in favour of the use of malt liquor is nearly as unanimous as the testimony against the use of spirits. Some medical officers, indeed, consider that it would hardly be safe even in India to deprive old spirit-drinkers of a long-accustomed stimulus; but admitting that such cases exist, they in no way detract from the weight of testimony on the other side, because the cases put forward are exceptional, and are indeed those in which a medical officer would in all probability prescribe alcoholic stimulants as medicines. Indeed it would not be advisable to exclude the use of spirits altogether from the army. There are cases, such as those alluded to, and there are particular kinds of service, as, for instance, field service, or duties exposing men to wet or damp, or very great fatigue, where a temporary stimulus would be of use, and where an issue of spirit under the advice of the medical officer might be permitted. But it is now known that many of these temporary uses to which spirits can be advantageously applied are much better met by tea or coffee, both of which have the special virtue of preventing waste under exertion, which spirit has not. Indeed there can be no doubt that a more systematic use of these beverages during times of fatigue and exposure would conduce more to the health of troops than any temporary issue of spirits.

Admitting, however, the existence of these exceptional cases, the weight of evidence is strongly in favour of malt liquor when compared with spirits.

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Speaking of the comparative effect in India on health of the use of these drinks, Deputy Inspector-General Stewart says— 803.

> "I believe the majority of soldiers would greatly prefer malt liquor to spirits, and the only reason for their not using beer almost exclusively is, their means being insufficient to procure it. I also feel assured that the use of malt liquor is far more conducive to health than that of spirits: I believe it would also lead to less crime and irregularity. I have further observed, that the consequences of prolonged over-indulgence in malt liquor are more manageable and less fatal in their result than when produced by a similar abuse of spirits."

Deputy Inspector-General Dempster in his paper says— Page 466.

> "Although I am of opinion that the freshly arrived European does best to confine himself to pure cold water or slightly acidulated drinks, yet if good malt liquor is only to be considered a substitute for rum, I would advocate its use from the very first."

These opinions of experienced medical officers give the substance of most of the evidence on the subject which will be found in the stational reports; but it must not be considered that malt liquor is advocated as a drink which it is indispensable for the soldier to use; the evidence only goes to prove that malt liquor is very greatly less injurious to health in a warm climate than spirits.

3546. We have already quoted what Dr. James Bird says on the subject. His evidence is against malt liquor and in favour of lighter drinks, and other witnesses give equally guarded opinions: thus, Dr. John McLennan says, "I apprehend that beer or porter ought to be taken with considerable moderation if health is to be retained in India"; and when he is asked, "But do you not think that a comparatively liberal use of beer or porter would be far less injurious than an unlimited use of ardent spirits?" he replies, "I think it would produce a different class of disease. I believe that great beer-drinkers and great porter-drinkers do suffer." 1205, 1206.

Light wines, and temperance drinks of various kinds, tea, and coffee are certainly those which would meet the case as regards health most effectually, were it possible to secure their use by the troops; and perhaps as great an inducement to sobriety as any of them, would be a plentiful supply of pure filtered cold water, obtained from fountains or water-taps at convenient places all over the stations.

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5650. The Indian Government has been put to an expense of nearly 200,000*l.* a year in supplying malt liquor from home for the troops in India, in order to place it within the reach of the men. And as the daily use of malt liquor is not necessary to health, this large sacrifice of revenue can be considered in no other light than as a tax to encourage men not to drink spirits, and is a striking evidence of the cost incurred by the intemperate habits of the British soldier. If the loss to the service from diseases occasioned by intemperance were added to this premium on the consumption of the less deleterious drink, it would amount to a very large item in the whole cost of the army.

5651, 5652. One of the advantages of hill stations is stated to be that, on account of the lower temperature of the climate, beer could be brewed at them, and a great public saving effected thereby.

Page 482. This has already been tried by Lieut.-Colonel Ouchterony and others. But the nature of the materials at their disposal and other circumstances rendered their success lonly partial. He, however, thinks the question of establishing breweries in India worthy of consideration by capitalists.

5654, 5657. Sir A. M. Tulloch is strongly of the view that beer should be brewed at all the higher stations, and the great cost of carriage saved.

The whole subject, indeed, is of most serious importance, and every inducement to temperance should be held out. Any change would have to be gradually introduced, beginning with young soldiers, and discouraging to the utmost the use of spirits, until the stigma of spirit-drinking be wiped off from the British army. The present inactive weary life which the soldier leads in warm climates powerfully fosters the habit of intemperance; and every facility for useful work and for rational instruction and recreation should be afforded him.

VENEREAL DISEASE.

VENEREAL DISEASE.

Venereal Disease, a frequent concomitant of intemperate habits, and, like these, fostered by want of occupation, is another of the causes enumerated as laying the foundation for ill health in India. It prevails to a very great extent in the army, and at almost every station. The proportion of venereal cases constantly in hospital is usually from 20 to 25 per cent. of the total sick. At some of

VENEREAL DISEASE.

the larger stations it very much exceeds this amount. At Bangalore and Roorkee the proportion at the time the return was made up was 50 per cent.; at Dinapore it was as high as 53 per cent.; and its influence on efficiency may be judged of from the fact stated by Dr. Maclean, that in the 1st Madras Fusiliers, a few years ago, 2393. the amount of syphilis was equivalent to the withdrawal from duty of one-fourth of a company daily. Many of the cases are of course of a slight character, but a considerable number become very serious in their progress, and render the men unfit for service. Many invalids are sent home from this cause, and in numerous other cases the constitution is undermined, and the patient becomes liable to other diseases.

There is no subject so difficult to deal with as this; and almost every plan for lessening the evil has been tried and found to fail. They all resolve themselves into two classes, namely, repressive measures of police, or marriage and moral restraint.

Many of the stational returns contain recommendations for the establishment of lock hospitals, and several witnesses have also strongly recommended them. They were introduced many years ago into India, but their use was after a while discontinued. The amount of venereal affections among the troops in all three Presidencies is so large (in 1860 it was 345 cases per 1,000 of the strength in Bengal, 249 in Madras, and 314 in Bombay) that there is an urgent need of some remedial measures. After considering the various plans which have been adopted in different countries, we have arrived at the conclusion that none are so likely to diminish this great scourge of the soldier in India as the re-organization of the measures formerly adopted in the three Presidencies, with any improvements which subsequent experience and consideration may point out as being required to meet the necessities of each locality.

Additional means of cleanliness, such as have been 4010 recommended by Mr. Acton, ought to be provided in all barrack lavatories. They would materially diminish the liability of the troops to this class of diseases.

It is observed that among native regiments, where marriage is not restricted, this disease is much less frequent than in European regiments, in which marriage is restricted.

VENEREAL DISEASE.

There are no means of knowing precisely to what extent these facts stand to each other in the relation of cause and effect, but they have led to certain proposals for increasing the proportion of marriages in the army. The present proportion of married soldiers in Her Majesty's regiments who have a claim for accommodation in barracks is 6 per cent. of the force (exclusive of serjeants) at home, and 12 per cent. in India. Since the amalgamation of the two services any augmentation in the number of marriages specially to meet the case of India would probably involve a change in the regulation throughout the army. Even at present, and with the existing per-centage, the number of women and children in a regiment is a very serious affair, and leads to much expense as well as suffering. It is beyond our province to decide what should be the proportion of marriages "with leave" for the whole army. Men of great experience consider that the proportion should be increased. Married men are generally the most healthy; they are the best soldiers, and a certain number of them are an example in a regiment; but when the regiment goes on foreign service a certain proportion of women only can be taken with it: and thus, so far as India is concerned, any large increase in the proportion of marriages would lead to wives and children being left behind, and exposed to much temptation and possibly to distress, while the domestic tie cannot fail to be weakened by long protracted absence. Some excellent remarks on the subject will be found in Miss Nightingale's paper. p. 368.

There is one means of reducing the temptation resulting in sexual disease, which ought to be encouraged, and that is to improve the soldier's condition in the way of occupation, instruction, and recreation,—in fact, to occupy his wasted time beneficially and rationally. The late General Jacob was fully aware of this, when he stated that "moral forces alone are of any value." Vide Appendix 2, Kurrachee Report.

So far as we can deal with this question, occupation appears to us to afford the most reasonable hope of diminishing this great scourge, by leading men away from the canteen and from vice.

MEANS OF RECREATION AND INSTRUCTION.

RECREATION, &c.

There is no period of military service in which the soldier is thrown more upon his own resources, and has fewer opportunities of employing them advantageously, than during his service in India. He rises at gun-fire, attends his parade or drill, over soon after sunrise. He then returns to his barrack, and during the hot season he is not allowed to leave it till late in the afternoon. At one o'clock he consumes a large amount of both animal food and vegetables, porter (perhaps a quart), and spirits. He has few or no means of occupying himself rationally. He lies on his bed and perhaps sleeps most of the day. He has his evening parade or drill, and his turn of guard duty once every five, seven, or ten days. Even at home this kind of regimen would be far from conducive to health. In India, both physically and morally, it helps to destroy it in men in the prime of life, with abundance of nervous power to dispose of. **Recreation, &c.**

The whole of this unwholesome proceeding is considered necessary for preserving the soldier; but it is not considered necessary to subject the officer to the same ordeal. He goes about, and even goes shooting, not only without detriment, but with great advantage to health; for the officers are much more healthy than the men.

Some means of passing the time are provided for the soldiers at all stations.

The usual games are long bullets, quoits, fives, and cricket; and almost every station has a ball-court and skittle-alley. 3206. Stational reports.

There are also libraries, and sometimes a theatre.

Soldiers' gardens and workshops have been tried at a few stations; but there are no covered places for exercise or for gymnastics.

The scale on which the existing means have been provided is the same as the very imperfect provision at home, without reference to the climate or to the much greater need of inducements to exercise, which require to be held out in India.

The men's amusements, such as they are, are always connected, more or less, with drink; and they are everywhere most deficient in amount. The men suffer much from ennui. For all practical purposes they are entirely idle; and they complain of what they feel everywhere, the "weary idleness" of their lives, and that there has been so little done in the way of giving them occupation. 1464, 1465. 479. 4470.

The want of exercise, and a coincident high rate of sickness and mortality, falls most heavily on the infantry. The cavalry regiments and artillery, who have, one way or other, much more physical exertion to undergo, are much more healthy.

RECREATION, &c.

From every station there are requirements for increased means of occupation, which we shall briefly notice in detail.

Foremost amongst the proposals is that for—

WORKSHOPS.

WORKSHOPS.

5102. *Vide* Stational reports. At most of the stations there are none at present; while it is admitted that everywhere they would be most useful. The only difference of opinion is as to the kind of work to be done, and how the workshops and tools are to be provided. All agree, however, that the trades should be useful, and that the soldiers should make money by them. The opinion at some stations is that the work done should be of such a kind as is required by natives, 4122, 1479. and should be sold to them. Colonel Campbell suggests cabinet-making, shoe-making especially, and printing.

4130. He states that he used to print all his own returns in this way, as well as papers for the civil authorities at 4134. Lucknow, and that at Meerut he was able to supply 100 pairs of boots to the 81st regiment, who could not otherwise have obtained them.

2955. Sir J. Lawrence proposes that the men should make "anything connected with their regiment," such as clothes, shoes, ironwork, &c.

As regards tools it is considered that Government should provide them in the first instance, and that they should be afterwards kept up by the regiment. It is satisfactory to know that every barrack in the Punjab has a workshop attached to it, and that the subject has already attracted considerable attention on the part of the Indian Government.

3960. Addenda, 1, 2, 3, p.238. Sir Proby Cautley puts in three letters from soldiers themselves, in proof of the advantage of occupying their spare time.

74. And the experience of the 3rd Bombay Fusiliers, extending over seven years, affords remarkable instances of improvement in the men's moral character from indoor occupations. Courts-martial and crimes diminished in proportion as the men were occupied for their own benefit. It has indeed been the opinion of some of the greatest army surgeons that the soldier should be permitted to do for himself whatever he can do, without injury to his health or discipline.

It has been proposed by Sir Alexander Tulloch and Colonel Durand to extend the soldier's occupation beyond the workshops, and to make him useful in outdoor work, such as in building barracks, or in magazines, or even in farm work; but the objection to such proposals is that, in a country where labour is so cheap, it would cost much more to have it done by the soldier than by the native worker. The gain would be in the health, comfort, and contentment of the men. WORKSHOPS. 5650, 5102. 5110.

Sir C. Trevelyan has also stated that soldiers would not come forward for public works, unless they were entirely excused from military duty for the time. Addendum to evidence, p. 301.

In the present state of the question, we propose that the existing means for carrying on indoor trades should be extended, or provided where they do not exist, under such regulations as would make it, as far as practicable, the interest of the men to occupy themselves profitably.

Sir Charles Trevelyan has laid before us an important suggestion for improving the soldier's condition, by holding out to him the prospect of bettering himself by his own exertions and good conduct. He proposes to select from regiments men of good character, trustworthy, with competent knowledge of reading, writing, and arithmetic, and an elementary knowledge of native languages, such as may now be obtained in schools; to submit these men to some suitable test, and then to train them for subordinate offices in the administrative departments. He states the plan to have been adopted successfully at Madras, and it is in our opinion well worthy of further consideration. It is, however, liable to the objection that it withdraws from the army the most trustworthy men, and thus tends to limit the supply of competent non-commissioned officers. 5357

SOLDIERS' GARDENS.

Attempts have been made to establish soldiers' gardens at several stations, chiefly with the view of occupying the men and providing vegetables. They have been mainly connected with regiments, an arrangement which no doubt has militated against their success. At some stations they have been very useful, and the men have taken great pleasure in them. At other stations they have not been so successful, apparently from the reason mentioned. The regiment may be called away at any time, irrespective of the state of the crop, so that the men may lose the result of their labour. But Sir A. Tulloch is of opinion that, if the gardens were attached to the station, and if an GARDENS. Stational reports. 966–7. 2952. 5554.

GARDENS. arrangement could be made by which the men were paid for their work the gardens would succeed; for the men, he says, are fond of gardening, and a very great proportion of them, after they are pensioned, become successful cultivators.

We are of opinion that every encouragement should be given to these gardens. They have often succeeded in other services, and are worthy of a fair trial in India; and an arrangement could easily be made by which the interests of the outgoing regiment could be protected. There is a proposal from one station to establish farms.

GYMNASTICS.

GYMNASTICS. Stational reports. It is scarcely necessary to advocate the introduction of gymnastic exercises. They have been extensively used in foreign armies, and a beginning has recently been made at home stations, and also at one or two foreign stations; but up to the present time there are no gymnasia in India, although the evidence from the stations proves that it would be most advantageous to provide them.

3220–3224. The evidence given before us shows that gymnastics would be "the best thing ever introduced into the service "in India," provided they were made "a parade," and the soldiers "dressed loosely" for the purpose.

The gymnasia should of course be covered, and provided with the usual fittings. According to the new medical regulations, the medical officer is required to see that the exercises are conducted in such a manner as not to be injurious to health; so that nothing further will be necessary than to provide the accommodation requisite.

The gymnastic sheds, if made sufficiently large, would afford another kind of accommodation very much required in India, viz., covered places where the men could walk and take exercise during the heat of the day, and in the rainy season, apart from the barrack rooms, where they are at present literally confined at these times. 1013, 4135, 5247, 3229.

On this subject of exercise, another most important question presents itself; viz., whether it is really necessary to confine the soldier so rigidly to his barracks during the heat of the day. The assumption seems to be that if allowed to go out he will expose himself and get sunstroke or some other disease, and so the health of the regiment would suffer. No evidence of this result has been adduced before us; and indeed it would, at first sight, appear doubtful whether confining a number of men all day in the same crowded room where they eat and sleep, in a state of absolute inaction, is not, in such a climate, productive of more injury than allowing the men legitimate liberty. The very idea of confinement is in itself injurious, and is very likely indeed to make the soldier miserable. Tell him, however, that he may go out, and, at all events, the idea of unnecessary restriction will be removed. We have evidence before us of men being allowed to go out shooting by their commanding officer in the hot season; and they were all the better for it. At all events they did not suffer in consequence. It is stated that the men liked shooting better than any other amusement: that the effect on their health and spirits is good: that the liberty given has never been, in any single instance, abused; and that it was quite a point of honour with them to behave well. GYMNASTICS. 3228. 1404. 3206–7. 3208.

At malarious stations, and during dangerous seasons, the same amount of liberty cannot, of course, be given with safety. 3227.

But Colonel Greathed has cited a remarkable instance of the benefit derived from this liberty in one of the hottest stations in India. 3203.

> In the hottest station, Deesa, where we were for three years, the mortality in the regiment was extremely small, and the general health of the men was excessively good. I mean to say that they were able to take the most active exercise there without suffering from the heat. We allowed them to go out shooting as much as they liked all over the country, and a man would go and walk 14 miles on foot from the barrack, and be back at night; their health and spirits were excellent, and there never was a single case of a difference between the soldiers and the natives in the whole of the three years during which time we gave them unbounded liberty; I mean, of course, to the good men.

In this, as in every other matter bearing on the soldier's health, no precise rule can be laid down. The present evil is, that there *is* a precise rule, viz., to confine the soldiers to barracks; while the nature of the case and the evidence both indicate, that the men should, on the contrary, have every facility given them for exercise, under such local restrictions as common sense points out.

LIBRARIES AND READING ROOMS.

At every station there is a library of some sort; but these libraries resemble closely the libraries at home stations. They are not a whit more comfortable, in general, LIBRARIES, &c. Stational reports.

LIBRARIES, &c. with a few exceptions, not so well lighted. This last defect they have in common with all the barrack rooms;
4123. for in India "deficiency of light" is a "universal fault." The supply of books is bad, and a "constant influx of
4119. "new works" of light literature is as much required as in England. There are very few proper reading rooms, fewer still of day rooms. There are no means of getting refreshment, such as tea, coffee, &c., connected with any of these rooms; although it is obviously most desirable to extend this class of accommodation to India, as is now being done at home stations. The men in India are in more need than they would be at home, of some place out of their bed rooms, where they can smoke, talk, and have harmless refreshment, without being exposed to the temptation of canteens.

3219. The men are always willing to take advantage of any rational means of recreation; and we have on evidence a very satisfactory instance of a successful coffee room, given
3777–3779. by Brigadier-General Russell. It was supported by voluntary contributions from officers and men. The library contained 1,000 volumes, and received a quarterly supply of books, newspapers, and periodicals from London. In the coffee room the men could have ginger beer, soda water, tea and coffee, biscuits, preserves, &c. It was at a distance from the canteen, expressly to keep the men out of the way of temptation; "the very smell of the liquor "being a temptation." All amusements near the canteen were discouraged, and only encouraged near the coffee room.

This is very much what is to be carried out at home. And having succeeded at one station in India, it ought to succeed at all with similar care.

Much improvement is required in lighting barracks and
4124. reading rooms in the long evenings. Small oil lamps, such as are at present used, give a very inefficient light. Wherever gas can be obtained it should be introduced at the Indian stations, as has been done at home. But there are very many stations in India where gas is not available, and it is worthy of consideration whether at these stations gas apparatus should not be provided. Of late years great improvements have been introduced in the manufacture of gas for single establishments by means of simple portable apparatus, which might be tried in India. Coal is not everywhere to be had, but there is at all barracks a certain amount of refuse matter which might be used for

the purpose. Lieut.-Colonel Ouchterlony has directed our attention particularly to the importance of the subject as regards the comfort of Indian barracks, and he shows that it would be economical even to convert the present allowance of oil into oil gas instead of burning it imperfectly in the defective lamps in use. We concur entirely in the importance of these suggestions for the comfort of the soldier.

LIBRARIES, &c.
Page 482.

THEATRES.

There are theatres at many stations, generally in large unoccupied barrack rooms; and sometimes there are rooms erected on purpose, which are also used for music, lectures, glee-singing, dancing, &c. The theatre is a great source of amusement, and occupies many men who have no other interest. To the actual performers it is "rather lucrative."

THEATRES.
3778.
Stational reports.

HOSPITALS.

The European hospitals are constructed on the same general plan as the barracks at the station. The soils, sub-soils, and means of external ventilation are of the same character, except that the hospitals are more isolated than the barrack buildings. The materials and construction are the same. The wards are on the ground floor, elevated at most a foot or two above the level, but without any passage of air beneath the floor. The better class of hospitals are those which consist of detached wards, with a single verandah, because they admit of easier ventilation. The worst are those which have a number of wards in the same building, or double aisles with more than two rows of beds between the opposite doors and windows.

HOSPITALS.
Abstract of Stational reports.

Although more constant care is exercised over the general sanitary state of hospitals than over that of barracks, it cannot be said that the great majority of them are well adapted for the treatment of sick.

The plans bear evidence of not having been subjected to any intelligent medical or sanitary revision; and they carry out the description of Sir R. Martin, that the buildings are generally defective, and the latrines and drains generally deficient. 175, 176.

The wards vary to an extraordinary degree in their dimensions and number of beds. Besides the usual "small wards" containing one or two beds, the numbers

Abstracts of Stational reports.

Hospitals.

vary from 16 beds per ward, as in Fort St. George, to 20, 30, 40, 166, 100, as at Dumdum and Kurrachee, 150, as at Dinapore, while at Trimulgherry (Secunderabad) there are two wards for 228 beds each.

The dimensions of course vary. The smallest class of wards are about 25 feet in length, and from that to 60, 70, 120 to 140, 334 feet, as at Dumdum, 349, as at Poona; and perhaps the longest hospital ward in existence is at Dinapore, no less than 633 feet in length. This ward is 21 feet wide and 18 feet high, being, in fact, nothing but a very long narrow passage, like the Scutari corridors, memorable in history for their immense fatality to the sick in them, owing in part to this long narrow construction.

The usual width of Indian hospital wards is from 20 to 25 feet, with windows and doors on opposite sides.

In a few they are 40 feet wide; at least 10 feet more than they ought to be for health.

The wards generally are of considerable and unnecessary height; 18 feet is a common height, as at Poona and Kurrachee. The height is, however, often from 20 to 30 feet, and even 42 feet, as at Trimulgherry. The question of height is a very important one, as indicating the extent of surface over-crowding; for, as in the barracks, excessive height crowds the hospital even with an apparently large cubic space per bed. At Trimulgherry *e.g.*, where the cubic space per bed is 1,000 feet, the superficial area is in some instances as small as 24 feet, and varies to 45 and 75. At Poona the beds have 1,300 cubic feet, but only 70 and 72 square feet. At Dinapore they have 1,000 and 1,500 cubic feet, but only from 52 to 88 square feet. At Dumdum, with 1,500 cubic feet, the superficial area is 78 feet. There are wards with from 1,800 to 2,000 cubic feet, in which the superficial area per bed is from 76 to 84 feet. In some better proportioned wards, 1,400 cubic feet give above 100 square feet. The largest superficial area given in any Indian hospital is at Deesa, in which the ward proportions are such that, with 2,000 cubic feet, they afford 114 square feet per bed.

The usual cubic space per bed is from 1,000 to 1,200 feet, rising occasionally to 1,500 and 1,800, and in certain exceptional cases to 1,900 and 2,000. There are hospitals, however, in which the amount falls far short of this. There is a ward at Surat which gives only 760. Above two-thirds of the sick at Fort William have 927 to 977

HOSPITALS.

cubic feet each. There are a number of wards in which the space varies from 660 to 960 feet. The smallest amount is at Ahmedabad, where it is between 456 and 1,050 feet. The superficial area in the great majority of cases is between 50 and 80 feet per bed. And hence in that element which is of the most importance in an unhealthy climate, viz., surface over-crowding, the hospitals as well as the barracks must be condemned.

It would be very advisable to reduce this great diversity in practice to one common rule, applying the rule to suit local circumstances.

The Royal Commission on the Sanitary State of the Army recommends, for the comparatively small stations in warm climates occupied by Her Majesty's troops, an allotment of 1,500 cubic feet per bed. The Indian stations vary so much in their topographical position and local climates, that it would be better to fix a minimum and maximum space between which the allotment at each station should be made. In all the more elevated, better ventilated, and healthier stations, we suggest the minimum of 1,500 cubic feet; and in all the low-lying, damp, and less healthy positions a larger space and superficial area are required. The beds should be arranged along the walls, with not less than 8 feet of wall space per bed in any case, and with the larger amount of cubic space, more wall space should be given. The superficial area per bed should never be less than 100 square feet with 1,500 cubic feet, and from 130 to 140 square feet with 2,000 cubic feet per bed.

VENTILATION OF HOSPITALS.

HOSPITAL VENTILATION.

The ventilation of hospitals is effected by opposite doors and windows, aided in many cases by a ventilator in the roof. The evidence before us shows that it varies very much in efficiency. From Sir R. Martin's experience it appears that there is a want of strict attention to ventilation. The old European hospitals are very badly ventilated, while the newer ones are described as very good indeed. The atmosphere in the older hospitals is often very bad and impure from over-crowding. Stational reports. 165. 1585, 1589, 1590.

All that has been said with reference to the draughts produced in barracks, applies with greater force to hospitals. As the ventilation is principally by the doors, and as there is insufficient control over it, it is very often 692.

HOSPITAL VENTILATION. extremely uncomfortable, especially to men with rheumatism, chronic dysentery, &c. in the cold months.

724, 725. Some hospitals are complained of as being dark, and wherever this is the case they must be close too. In one instance, at Meerut, there is so little light that operations have actually to be performed in the verandah outside. In some instances there appears to be no well-lighted room in which surgical operations can be performed.

Dark hospitals are unsuitable for sick.

A sufficiency of light is as necessary as a sufficiency of fresh air; and it is quite possible to supply both without too much sunlight or too many draughts.

What we have said respecting the ventilation of barracks applies to hospitals. It should be provided for along the ridge and under the eaves; and the patients should on no account be exposed to draughts, either from doors or windows.

Unless the wards be raised a sufficient distance from the ground, it is impossible to supply them with fresh air. As at present constructed, malaria from the ground must necessarily permeate the whole building. The only way to avoid this evil as far as practicable, is to construct hospitals always of two floors, placing the sick only on the upper floor, and providing for a free ventilation between the ward and the ground.

HOSPITAL ABLUTION AND BATH ACCOMMODATION.

HOSPITAL ABLUTION.

Stational reports. The ablution and bath accommodation consists occasionally of a "tin pot" with which "the sick generally pour "the water over themselves," as at Bombay. Very frequently there is no ablution room, and the patients wash themselves if at all in the open verandahs in all weathers. Generally there are no basin-stands: and the sick have often to sit on the ground to wash their faces. The only bathing is done in wooden tubs, to which water is carried by bheesties; and it is usually poured over the patients. There are no warm baths, and indeed no baths at all in the sense in which they are understood in all the hospitals of Europe, and even in the military hospitals at home.

3508. The means of cleanliness for sick as sick, are, to sum them up, *nil*.

Every sick ward should have its basin stand with fixed basins, and a bath, both with hot and cold water constantly laid on, in a separate small room attached.

Hospital Drainage.—Water-closets.

Hospital Drainage.

Stational reports.

Hospitals are no more drained than the barracks to which they belong. There is surface drainage; but the roof water is allowed to sink into the ground. There is no subsoil drainage; and all fluid refuse has to be removed either by hand, or, by escaping as it best may, to remove itself. No hospital can long continue healthy under such circumstances. All hospitals must be drained together with the barracks to which they belong.

There are no water-closets in any hospital in India. The usual arrangement is to have night-chairs placed in a small room adjacent to the ward, or to have privies at a distance of from 30 to 80 feet, connected with the hospital (by a covered way), and of the same construction as the barrack privies, often placed over cesspits cleansed once a day, and sometimes provided with pans which are removed daily. The arrangements are those of a camp hospital, and have long since been condemned in Europe.

Every ward should have a water-closet, if practicable, with one or two seats according to its size, having a separate ventilation. It is the only healthy arrangement for sick; every other is liable to danger, especially in the event of cholera or dysentery prevailing, as nothing but immediate removal can prevent the risk of dangerous emanations. In stations where from the want of water no water-closets can be provided, provision for such immediate removal ought to be made.

Diet Tables and Cook-Houses.

Hospital Diet.

The diet tables now in use in the Indian army are similar to those formerly in use in the British army. They lay down a certain number of fixed diets for every day use, to which the medical officer may add extra articles at his discretion. This practice was attended with many disadvantages in Queen's regiments, to avoid which, a new scale of diets containing sufficient variety for all hospital purposes, and rendering extra articles unnecessary was made matter of regulation. For the sake of uniformity, the new diet table should be adopted for all regimental and general hospitals in India, so far as the supplies will admit of it.

Stational reports.

Hospital cook-houses are similar to barrack ones; they are in small detached buildings, and are provided with the usual small fire-places and utensils. There is not

HOSPITAL DIET.

sufficient variety in the cooking, and sometimes it is complained of as being bad. The cooks are chiefly natives, and have no training in the specialties of hospital cooking; or they are equally untrained men taken from the ranks and liable to be withdrawn at any time. On home stations arrangements are in progress to supply every hospital with a trained cook from the purveyor's branch of the army hospital corps. The cook will be responsible to the head of his department for the state of the hospital cooking; and any cause of complaint will be removable. It would be very desirable that some such responsible system should be extended to hospitals for Her Majesty's troops, while serving in India.

HOSPITAL BEDDING.

HOSPITAL BEDDING.

Stational reports.

Hospital bedsteads are generally of wood, sometimes of iron. Wooden bedsteads are at all times, but especially in warm climates, subject to vermin; and complaint is made of the expense incurred by the men breaking the bedsteads in their efforts to get the vermin out. The bedding is of mattresses and pillows stuffed with a variety of materials, chiefly straw and country hemp. By far the best form of bedstead is the iron hospital bedstead in use at home; it should be supplied at all Indian stations. The best material for hospital bedding is hair, now supplied by regulation for mattresses, bolsters, and pillows, in all hospitals of the British army.

HOSPITAL ATTENDANCE.

HOSPITAL ATTENDANCE.

Stational reports.

Attendance on the sick is mainly provided for by a subordinate medical department, with native assistants. The number is fixed by regulation; but the numbers actually employed appear to differ at different stations. They consist of apothecaries, steward, apprentices, dressers, cooks, washermen, water-carriers, tailors, barber, ward coolies, nurses, bearers, sweepers, &c.

The regular establishment for an European corps contains 79 of these officials. In the hot season there are added 34 water-carriers, 23 coolies for throwing water on tatties, 104 coolies for moving the punkahs, making the total establishment 240.

Besides these, there is the regimental hospital serjeant, and orderlies taken from the regiment, who are supplied in all serious cases or at the request of the sick.

So far as numbers are concerned, the supply of attendants is no doubt on the most liberal scale, when contrasted with that which is found in practice to be sufficient for regimental hospital service at home.

HOSPITAL ATTENDANCE.

Generally we may consider that wherever "a comrade "can be told off from the ranks" to attend "upon any case "which desires it," there can be no discipline, nothing which can be called efficient nursing of the sick, in such a hospital.

The hospital establishment for a battalion of infantry at home, according to the recent warrant, consists of 1 serjeant for discipline and for attendance on the sick, with 5 privates; also 1 serjeant, with 2 or 3 privates, belonging to the purveyor's department, for providing the supplies, cooking, and care of stores.

The regular establishment of a battalion at home would therefore consist of 2 serjeants and 7 or 8 privates, while in India the same battalion would have a regular establishment of 79, capable of being extended to 240 in hot weather.

The hospital serjeant receives 1*s.* per day additional pay for compounding, if he qualifies himself for that office; and the cost of a compounder is saved. In India the dispensing is done by six officers of the subordinate medical establishment.

Even in temperate climates, and in civilized countries, where the water is brought to the door, the laying on hot and cold water all over a hospital and the use of lifts, makes the difference of one attendant to every 30 patients. While the most objectionable system of water-carrying, instead of water-laying-on, lasts in India, where not only has every drop of water to be carried to the hospital before it can be carried over it, but to be carried away again when foul, the cost of this kind of arrangement cannot be far short of two-thirds of the whole; and the expense of a civilized system of water-supply and of drainage, may prove to be actually less than keeping up this enormous staff.

As regards the quality of attendance, there can be no doubt that natives, however kind they may be, if untrained, are not the class of attendants the sick want. The same applies to "comrades from the ranks." The hospital corps men at home, under the new warrant, are, it is true, taken from the ranks; but when they are

Miss Nightingale's paper, p. 363.

HOSPITAL ATTENDANCE.

trained they cannot be returned to the ranks, except for misconduct or inefficiency.

As in future each battalion will carry with it its quota to India, it is worthy of consideration whether the Indian hospital system might not be revised, with advantage and economy.

The stational returns contain a great number of complaints as to the untrained character of the hospital nursing.

The hospital establishments throughout India are generally regimental. There are very few general hospitals. The superior advantages of these for the sick, as regards their care and comfort, are admitted; and several are being organized at home and on foreign stations, in terms of the new medical regulations. Female nurses have already been introduced into one of these; and the system is to be extended to others. The only instance of the kind in India appears to be the general depôt hospital at Allahabad, consisting of 400 beds. Six European nurses have been attached to this hospital since 1858, and are stated to be a great comfort to the sick.

Vide Allahabad Stational report.

Female nurses are not suited to, nor are they used for regimental hospitals; but wherever, on large stations, general hospitals are organized, they should be introduced; and in these, as well as in the instance of Allahabad, the nursing should be organized according to the regulations in use for Her Majesty's service. Miss Nightingale, in her Observations, has made some excellent remarks on the present state of Indian military hospitals, and on their want of adaptation for the care and speedy recovery of sick. She considers them rather as being like camp hospitals than as establishments adapted for permanent barracks or stations, and consequently deficient in many of the most important requisites for efficient nursing and treatment. She points out many defects which might be remedied, and considers the hospital arrangements generally as of a makeshift character, requiring great improvement to make them at all comparable with those of the recently improved military hospitals at home.

From the evidence it appears that every station for British troops in India has one or more female hospitals for the sick of soldiers' families, generally under the same management as the regimental hospitals at the station, and that they are in most cases supplied with matrons, native nurses, and midwives. The attendance and nursing is generally considered sufficient, but the buildings not so in all cases.

HOSPITAL ATTENDANCE.

We have now completed our analysis of the information laid before us regarding the various influences affecting the soldier's health and efficiency in India. In weighing the evidence, especially that referring to the sanitary condition of stations, it is impossible to evade the conclusion that a great part of the sickness and premature mortality in the Indian army is due to preventible causes. In times past climate has been popularly blamed for results which would follow in their degree similar causes anywhere. Our inquiry has shown that the causes must be sought in defective sanitary condition and in bad habits, and it is in the correction of these that we must look for diminished mortality and increased efficiency. In the words of Miss Nightingale, " it would require very strong " evidence indeed to convince the people of this country " that the epidemics which have devastated India arise " from any other causes than those which the stational " returns and the evidence prove to exist in what one " may call a state of absolute perfection in the Indian " towns, but which have been removed with entire success " in this country."

Observations.

HILL STATIONS.

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For some years past the conviction has been gaining ground in India that, in order to diminish the high rate of sickness and mortality, it will be necessary to remove a considerable proportion of the troops from low malarious plains and river-banks, and to station them on high tablelands or isolated mountains. It has been assumed that by simply removing the troops from the influence of heat, moisture, and malaria, which conjointly are admitted to sap the constitution, and predispose the men to disease, troops would be kept in a state of efficiency similar to that of colder climates. This proposition has two aspects; 1, as regards health; 2, as regards the military occupation of the country; and we must consider it with reference to both of these, in order to estimate its exact value, and the extent to which it can be carried into effect.

So far as health is concerned, the evidence in the stational reports is, with a trifling exception, decidedly in favour of mountain climates, especially during the

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earlier years of service; and the evidence of witnesses tends to the same result. Hitherto, however, there has been no experience on any large scale of the sanitary influence of hill climates on healthy troops. For it has been the practice to send to the hills men either absolutely diseased or convalescing from severe diseases, or sickly regiments; and, so far as these classes are concerned, hill climates have been found beneficial in certain descriptions of cases only, but in all others either of doubtful efficacy or positively injurious.

215. We are indebted to Sir Ranald Martin for having brought this subject prominently before us, and also for having directed the attention of the Indian Government to its importance. The *primâ facie* evidence derived from the superior healthiness of the inhabitants of elevated plains and mountain regions generally, would alone warrant a careful local inquiry into the adaptation of such Indian climates to European constitutions. But, besides this, a large amount of experience has already been obtained in the case of civilians and military officers, who for many years past have been in the habit of resorting to the hills, in order to recover from the exhaustion produced by service on the plains.

3047, 3050. Similar evidence is afforded by the Lawrence asylums, one of which, containing 500 children, is at Sunnawur, and the other at Mount Aboo. Children are taken in at four or five years; and during their residence they look like English children, while those in the plains below are "pale, pasty, and wasted."

4501. There is a convent at Darjeeling, with 11 adults and 28 children sent up from the plains; during 13 years there had been no death among the children, while the mortality among the children in Bengal is 84 per 1,000 per annum.

As, of all subjects, children are the most susceptible to sanitary defects of any kind, this experience proves that these hill stations are not necessarily unhealthy, and that, if found so for grown men in health, the cause lies elsewhere than in the climate.

It may fairly be taken for granted, that properly selected hill stations, under proper sanitary management, would be of great advantage to the health of the army; and we propose, therefore, to confine our attention chiefly to those points in the selection which have been brought before us in evidence. Indeed Sir Ranald Martin, while 270.

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strongly advocating the adoption of hill stations, states that the whole subject has to be investigated *ab initio*, both as regards " the mountain ranges " and " the climates " most suited to the occupation of European troops."

The stations which have hitherto been selected as hill sanitaria are of two classes; those on the spurs of the Himalayas, chiefly occupying elevated and narrow mountain crests, and those on the table-lands of southern India. There is another class, of which there are only one or two examples, viz., isolated mountains, such as Mount Aboo and Ramandroog. The least elevated of the Himalaya stations is Subathoo, 4,000 feet above the level of the sea, and the highest are Darjeeling and Simla, 8,000 feet above the sea. The southern Indian stations vary from 5,000 to upwards of 7,000 feet in height. Mount Aboo has an elevation of upwards of 4,000 feet, and Ramandroog of 3,400 feet.

The majority of the stations being on the outer face of the mountain ranges, and at an elevation where the heaviest rains occur, receive the first impact of the monsoon; and the consequence is that they are all wet, and subject to cold fogs. The annual rain-fall in the Himalaya stations varies from 70 inches to 132 inches, as at Darjeeling. The rainfall at Mahableshwur, in Bombay, is actually 240 inches per annum. In the Neilgherry group, which are not exposed to the monsoon, the rain fall is from 50 to 60 inches a year. The mean temperature varies, of course, with the latitude and elevation. In the Himalaya group, the highest mean is from 64° to 78°; in the Neilgherries, from 63° to 70°. The lowest mean in the Himalayas is from 35° to 42°; the lowest in the Neilgherries is from 53° to 60°.

The great objection to the Himalaya group is that already stated, viz., the damp climate and excessive rainfall, the only way of avoiding which would be to select stations at a lower elevation, or more in the heart of the mountains. In this way the force of the monsoon would 140. be avoided; but, on the other hand, the difficulty and cost of transit, and the long distance to be traversed by 2372. troops in descending to the plains, present serious obstacles.

The present stations are described as having clouds 1113. continually hanging about them, dispersing and re-forming very quickly; at one moment in sunshine, with inconvenient warmth; at another, in cloud, with considerable chill.

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Stational reports.

An elevation of from 6,000 to 8,000 feet is also prejudicial, because, although malaria is to a great extent absent at such a height, troops proceeding from the hot moist plains, where the function of perspiration has been so active, are suddenly exposed to lower temperature, to cold damp air; the result of which is that they become liable to other diseases, chiefly of the bowels and chest.

The diseases of a colder climate are substituted for those of a warmer one. Much has depended on want of care in moving the men: no sufficient attention has been paid to change of clothing, diet, or exercise. The men have been usually left to wander down into the ravines and valleys, filled with jungle, where the sun is intensely hot; and, as we shall presently show, the sanitary condition of the stations has been much neglected.

We have the mortality returns for hill stations for a few years only, and they throw but imperfect light on their influence on health.

The mortality at Murree, 7,000 feet above the level of the sea, was for five years at the rate of 92 in 1,000. It was an invalid depôt, and several sick men died there, who had been attacked at other stations. Of 39 deaths in Murree, 12 were by dysentery; of 964 attacks, 644 were by zymotic diseases.

3035. These elevated regions are not even exempt from epidemics, of which a remarkable illustration occurred at Murree. Sir John Lawrence informs us that he saw cholera raging there "in a magnificent climate, a beautiful
4520. "site and fine barracks, and there was nobody else sick "but the soldiers." Out of 254 men in barracks, 42 were attacked, and 31 died, of cholera. Not one officer suffered, a clear proof that the men were exposed to some specially unfavourable condition.

The important military position in front of Simla is occupied by Kussowlie, Subathoo, and Dugshai, at which regiments or detachments have been stationed for some years. The mortality at Kussowlie (440 men, 8 years) was at the rate of 37 in 1,000; at Dugshai (717 men, 6 years) 36; at Subathoo (209 men, 3 years) 68 in 1,000. The excess of the mortality was chiefly due to dysentery, diarrhœa, apoplexy, hepatitis, fever; and upon subtracting zymotic diseases, the mortality is reduced to the same rate as prevails in the districts of the higher plains in India. In Subathoo the mortality was at the rate of 15, in Dugshai of 28 per 1,000 in 1860.

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Nynee Tâl near Almorah, 7,609 feet above the sea, is now occupied by a regiment, but supplies no returns. Landour (7,000 feet) is a small invalid and sanitary depôt; the mortality was, for 10 years, after excluding the invalids, at the rate of 61 in 1,000. Of 67 deaths, 17 were by dysentery. Darjeeling, in Sikkim, is the hill station nearest to Calcutta. It was a convalescent depôt; and for 9 years the mortality was at the rate of 39 in 1,000. Of 25 deaths 8 were by dysentery.

It must be borne in mind that all the Himalayan hill stations are of comparatively recent formation, and that the mortality is in every case augmented by the deaths of men who were attacked at other stations. The supply of fruit and vegetables is often defective. The water is sometimes polluted, and the men suffer from descending into the close ravines.

Stational reports. 1109, 1560.

Notwithstanding these objections, merely local, the evidence is in favour of carefully selected positions on ridges or mountain ranges, as being decidedly advantageous to European health, although experience has proved that they are so only within certain limits.

Sir J. Lawrence, while admitting that men would be healthier on hills than on plains, states that there are constitutions which do not benefit by hill residence. And Colonel Greathed states that, though the men look better on the hills, the returns show no great difference as regards health; but he admits, at the same time, that the sanitary condition of the stations was very bad. 2963. 3261.

This last point is one of primary importance, for it is clear that, if hill stations are supplied with bad barracks and hospitals, deficient water-supply, no drainage, and if the vicinity is allowed to become a reservoir of filth, troops leaving the plains for the hills will leave behind them malaria, to find in its stead foul air (and perhaps more intensely foul air) from other causes.

The stations being generally on ridges and near ravines, afford great facilities for perpetrating all kinds of nuisance. There is a large native population, over whom very little sanitary inspection is exercised. At Simla, the "conservancy" is described as having been as bad as could be, the ravines full of dead animals, together with the ordure of many thousand natives. There are no public conveniences. The water-supply was scanty, and liable to pollution. The effluvia from the ravines were "as strong as "on going into a sewer." A large amount of hill diarrhœa 4484, 4487. 4486-4487. 4492.

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prevailed among the residents, which Surgeon Major Grant attributed mainly to want of sanitary precautions, and neither to the elevation nor to the damp atmosphere. He states that the disease had gradually increased with the increase of population, and that "the authorities seemed "to think that, because the climate was cold, the men "might be crowded together, and all sanitary arrange-"ments neglected with impunity." The men were crowded
3267. together at Kussowlie with fatal results. Colonel Greathed informs us that, when the rains begin, the nuisance produced by the washing down of the filth is intolerable.

Vide Abstracts and Stational reports.

The reports on the stations give the evidence of a number of officers on this same subject. We learn from them that the barracks at several stations in the Simla group, such as Subathoo and Kussowlie, are bad in structure and plan; that at Mount Aboo the barracks are erected in a malarious gully; that at Nynee Tâl, 7,600 feet above the sea, the huts have been built in a narrow defile, where the earth is damp, and a perfect marsh during rains, and where the huts are exposed to violent gusts of wind. The bazaars are filthy and crowded. There are neither drains nor latrines, and "the stench is at times over-"powering," causing nuisance in the barracks. At Darjeeling the medical officer reports the sanitary condition of the hospital for convalescents as "bad," and he states that he had been making representations for five years as to a privy under a verandah connected with the hospital, before he could get the nuisance abated, which rendered the ward so offensive that the sick had to be moved out of it. The drainage is defective, and "the inducements "for the sick to remain dirty are," he thinks, "greater "than those to be clean."

The hill stations on the Neilgherries are not exposed to the same objection as regards climate; the rain-fall is much less, and the air is drier; there are fewer fogs, and altogether this group of stations is perhaps the best yet occupied. But even here the usual fatality followed neglect of very obvious sanitary measures. When the station at Jackatalla, now called Wellington, was first occupied, much disappointment was experienced on account of the high rate of sickness and mortality.

The mortality of the 74th Highlanders, during three years at Jackatalla, was at the rate of 39 per 1,000. Of the 68 deaths in the regiment, 19 deaths were by dysentery, 6 by diarrhœa, 8 by cholera, 6 by apoplexy, 9 by

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hepatitis. The barrack square "was frequently an immense swamp." In 1860 the mortality of the 60th Rifles, third battalion, was at the rate of 24 in 1,000 at Jackatalla; the mortality of the 66th Foot at Cannanore was 11 in 1,000 during the same year. Cannanore is on the coast, and 20 feet above the sea level.

On inquiry into the causes of this sickness, it was discovered that, besides want of attention to drainage, the large body of from 2,000 to 3,000 workmen employed on the buildings had been under no sanitary control, so that the ground for miles about was "one immense privy," and the troops suffered to a great extent from bowel disease in consequence; but since sanitary arrangements were thoroughly carried out, the sickness has been under one per cent. of the strength. 2336.

One thing is quite clear, that it will never do to trust simply to elevation above the plains to keep the army in health.

Malaria has been blown up ravines in India far above the fever range, over sites otherwise perfectly healthy; and those who slept within its influence have been attacked with fever and died. 4258.

We have shown that epidemic disease originates at hill stations just as it would do at unhealthy stations at home. Hence, in selecting sites on hills, all the precautions necessary for selecting sites on plains are just as necessary. The climate, exposure, subsoils, drainage, water-supply, local diseases, and the relation to distant sources of malaria, require careful examination; and all buildings, whether for European troops or natives, must be subjected to the sanitary conditions as to structure and supervision which are everywhere required.

It is always desirable, as suggested by several witnesses, to test new hill stations by a residence at them of a certain number of Europeans and natives, before they are occupied. The preponderance of evidence is rather in favour of heights of moderate elevation than of those so high as Darjeeling. Sir R. Martin states that the best elevations have yet to be determined, and that probably heights of from 2,000 to 4,000 feet, if otherwise suitable, would be best in practice.

We are of the same opinion, and would suggest that stations of intermediate height should be carefully sought for, and their sanitary relations investigated.

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3051. It is objected to stations on narrow mountain ridges that there is not sufficient space for healthy exercise; that the men can scarcely leave the immediate vicinity, and suffer from confinement. The men complain of their forced
1143, 6, 7. inaction, and dislike these stations. But this admits of remedy. Sites very defective in this respect should not be chosen, or, if already chosen, it is always possible to find space for gardens by terracing the slopes; and occupation may be given to the men in this way. Abundant means of exercise are indispensable to health on the hills.

1144, 5321. The men find the hill stations dull also, it is to be feared, from their being cut off from the debauchery and excitement of the plains. But on the other hand, this isolation from the plains is considered to be a great advantage as regards health, by enabling a more strict police to be exercised, whereby the sources of debauchery are cut off.

We next proceed to consider the extent to which hill stations can be occupied consistently with military and political considerations. There is some diversity of opinion on this point, as there is also on the precise manner in which hill stations should be used. On one point, however, all are agreed, viz., that sickly regiments should not be sent to the hills; for such regiments invariably suffer in health.

147. As regards disease, the mountains of India are but partially curative.

There is also a general concurrence of opinion that healthy regiments, or parts of regiments, should be stationed on the hills, and that men who are beginning to suffer in health from service on the plains should be sent to the hills. Of this latter class there is a considerable proportion in all regiments. If left in the plains, many of these would become subjects of actual disease; and from the nature of the case they should be sent to the hills for restoration to health. As regards the others, it has been proposed to locate most of the effective force on hill stations, at such a distance from the plains as would enable them, either by roads or railroads, to be thrown on any point where their services might be required.

5122. But it is very soundly objected to this by Col. Durand, that any large proportion of the troops cannot be permanently quartered on the hills without detriment to the military occupation of the country; that to do so would be practically to evacuate the country; that it would be

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most dangerous not to occupy the great strategical points, upon which the security of the country depends; that there are many posts which must be held, healthy or unhealthy. 5135. Several illustrations of these dangers occurred during the 2964. mutiny, where important points were lost from deficiency of force before regiments could be brought down from the hills. It is clear that all necessary points in the plains 5319. must be held by a sufficient force; and hence, whatever proportion of troops is placed on the hills, must be considered as "a reserve." Both Sir John Lawrence and Sir Charles Trevelyan concur in this, that not more than one- 2970, 5319. third of the force should be disposed of in this manner. Such a proportion would enable the remaining two-thirds of the force to take their turn on the hills. But here another question presents itself, viz., what are the points in the plains which must be held? This all important element in the question has not yet been settled. It depends upon the military authorities to do so; and as soon as it has been done, we recommend that hill stations conveniently situated for the strategical points should be provided wherever it is possible.

Possibly some of the more unhealthy stations in Lower Bengal could be abandoned without risk to the military occupation of the country, and with great advantage to the health of the army; but, at the same time, it is necessary to bear in mind that the stations in worst repute are in such a bad sanitary condition, that it is not easy to say to what extent the health of the troops might not be improved by suitable works and precautions. It is said *Vide* Kherwarrah Report. of even some of the worst of them that they have never had "fair play" on account of this want of sanitary care.

The hill stations must, of course, be at the shortest 5123. possible distance from those on the plains; but the introduction of railroads will facilitate their occupation, and enable more distant stations to be used.

As regards the Madras Presidency, there would be no 4269, 4270. 5342. difficulty in locating the requisite number of troops on the hills. The Neilgherry range is one great hill station, sufficient for nearly every purpose, and which will shortly be connected, more or less, with every station by railway. Other stations have also been proposed at Ramanmullay, Shevaroy, and the Pulney hills. In the Bengal Presidency the spurs of the Himalaya have been chiefly used; but there are many hill districts besides these worthy of careful examination. The chief hill stations in the Bombay

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Presidency are at Mahableshwur and Mount Aboo. The former from its local position, as already stated, is very wet; but many other more available points might be discovered.

The result of our inquiry into the important subject of hill stations may be given in a very few words, as follows :—

1. To reduce to a minimum the strategic points on the alluvial plains, and to hold in force as few unhealthy stations as possible.

2. To locate a third part of the force required to hold these points on the nearest convenient hill station or elevated plain, including in this third, by preference, men whose constitutions are becoming enfeebled, and recruits on their first arrival; and to give the other two-thirds their turn.

3. Never to trust to simple elevation as a means of protecting health; but, while occupying the best available elevated stations, to place these (for they want it just as much as the stations in the plains), in the very best sanitary condition.

SANITARIA.

Sanitaria.

Besides the hill stations, there are several places along the sea-coast of India which have been found very useful in restoring health after certain diseases. The most successful of these is Waltair, on the Madras coast, which occupies a range of sand hills close to the sea, fully exposed to the sea breeze. Others have been proposed in India, at the Cape, and especially in Western Australia. The object which these places is intended to serve is not the prevention of disease so much as restoration to health after disease.

The Cape of Good Hope has at various times been strongly recommended for this object; but its distance is so great as to render it of doubtful utility, and besides it is alleged that the climate of the Cape is not very suitable for Indian diseases.

Western Australia, though not much nearer, appears to possess many advantages as a locality for a sanitarium.

We have taken evidence on this point from Vice-Admiral Sir James Stirling, K.C.B., late Governor of the Colony; from Staff-Surgeon Rennie, who has been stationed at Fremantle for 6½ years; and from Mr. Roe, Surveyor-General.

SANITARIA.

It appears from the evidence of these gentlemen, that the climate, although possessing a temperature ranging between 45° and 100° Fahr. is dry, fine, healthy, and invigorating. That the mortality rate is low, and that there are no particular local diseases. That water and supplies are abundant and good, and that the most favourable parts of the colony could be reached from Calcutta and Bombay in about 20 days by sailing vessel, and in from 14 to 16 days by steam. 868-872. 864, 3382. 3355.

The evidence on the subject is not so conclusive as to enable us to recommend the adoption of Western Australia as a position for a sanitarium; but it is sufficient to justify a recommendation that its claims be further inquired into.

We have seen that hill stations are not curative, and that in fact diseased men had better be removed out of India. The only question is whether a complete sanitary system for the Indian army should include a foreign sanitarium, or whether it would not be better to send diseased men home at once. There is much to be said on both sides, but there is no direct evidence of a decisive character either way. It is highly probable that certain cases of disease would so far recover as to enable the sufferers to resume duty after a short residence out of the country, and for this class of cases Australia would be useful. It is on this ground that we would advise further inquiry.

But for cases in which return to comparative health would probably not be accompanied by the likelihood of return to efficient service, the best way would be to send the sufferers home.

As the veterans of the army advance in years the warm climate of India out of the region of malaria appears to suit them. Bangalore is a striking example.

NATIVE LINES.

NATIVE LINES.

Native troops generally hut themselves; but at a few stations there are barracks. Hutting is the rule, and each man receives a small sum from Government for the purpose. The huts are made of very light materials, bamboo and matting, and cost about two rupees. The men generally sleep outside, except in the rains. The huts differ in dimensions, and are not constructed on any general rule. Those for single men are, say 10 feet long by 7½ wide, and 7 feet high, containing about 525 cubic feet. Stational reports. 5826.

NATIVE LINES. A married soldier builds a hut of from 12 to 18 feet long, 12 to 8 feet wide, and 8 to 10 feet high.

The huts are put up without any order or regularity. Nobody interferes; the outline only of the native lines is marked out.

5695. The huts are huddled together, without drainage or attention to ventilation.

5700. Officers sometimes induce the men to arrange the huts
5818. in line, with a space between. But of sanitary supervision there is none.

5729. Natives generally raise the floor of their huts with earth taken from a hole close to the door, in which hole all manner of filth is deposited.

5899. A native cantonment is nothing but a very bad camp, in which every sanitary precaution is ignored, and the water is often very impure.

The only advantage the native possesses is that of having a separate hut.

Native troops, as might be expected, suffer much in efficiency from epidemic disease. According to the returns their mortality is less than that of European soldiers; but many men are sent home from their regiments to die from
5746–5748. disease contracted in the regiment. Such cases are not entered on the death list. The condition of the native lines undoubtedly exerts a very injurious influence upon the troops.

It is usually considered that little or no sanitary improvement can be carried out among natives on account of caste prejudices, but it may be doubted whether such
5728, 5730. is really the case. Natives, it is stated, would make no objection to clearing and leveling ground, drainage, and cleanliness, if it were properly explained to them that it was done only for the protection of their health; they object solely on the ground of cost and trouble; but if the requisite improvements were made without additional cost to themselves, and with full explanations of their nature, it is not likely that any serious difficulty would arise. It is, however, superfluous to observe on the necessity of caution in dealing with this part of the question.

Apart from any consideration of humanity, there would be a saving in improving the condition of native lines. There may be plenty of raw material for soldiers in India, but it requires training and drilling. An efficient native soldier costs money; and when he gets into hospital, or is invalided, or dies, Government incurs great expense in loss of service, medical assistance, &c. Any system of improvement required for stations should therefore include native lines.

NATIVE LINES.

NATIVE HOSPITALS.

NATIVE HOSPITALS.

Native hospitals have very few, if any, of the conveniences of hospitals in Europe. They generally consist of a simply-constructed hut, with a pent roof supported on pillars so as to form a verandah. There are numerous doors, and unglazed windows with wooden shutters, which are the usual means of ventilation. Two or three small rooms are generally cut off from the end of the hut or the corners of the verandah, and there is a court behind containing privies, cook-house, dead-house, &c. The hospital construction and administration appear to have been framed on the habits of natives, rather than on what is necessary for the recovery of sick. There seems to be no regulation as to the amount of bed space. The allowance per bed in different hospitals is 294, 386, 570, 620, 840, 1,000, 1,500, up to 1,700 or 1,800 cubic feet. There are no lavatories and no proper baths. The sick wash according to their own habits, and there are tubs in which they can sit to have water poured over them. Ablution is generally performed in the open air in the verandah, or the patients are allowed to go home to wash. In one native hospital the sick are allowed to wash and bathe in a tank in front of it. The means of cleanliness for sick are admitted to be altogether insufficient for medical purposes. The medical officer has no control over diet or cooking, and hence patients often make themselves ill by errors in quantity or quality. The cook-houses have only native fireplaces; they are sometimes close to the privies and dead-houses, and the smell pervades them. The privy is merely a walled off space kept clean by sweepers. In the ordinary sense of hospital offices there are none. Sometimes the surgery is used for all purposes. The attendance on the sick is insufficient. In one hospital of 30 beds the only attendant is the assistant apothecary; but in this, as in other similar cases, native orderlies may be obtained from the regiment. Bedsteads are usually of wood; the natives appear in some cases to supply their own bedding, and in others beds are given out on the requisition of the surgeon. Hospital washing is done by washermen, occasionally by comrades.

Vide Abstracts of Stational reports.

5881.

Miss Nightingale's observations, p. 364–7.

NATIVE HOSPITALS.

In practice the sole function of the medical officer in these native hospitals is to order drugs. The only thing done to promote the recovery or comfort of the sick is to supply drugs. In everything else, in diets, baths, &c., the medical officer has no power.

The system seems to be the growth of circumstances, and of an indifferent deference to supposed caste prejudices.

Little attempt seems to have been made to conciliate with such native prejudices or habits the use of means which are essential to the recovery of the native, quite as much as, or more so than to that of the European.

This wise conciliation would effect great improvement in the stations among healthy native soldiers. Could it not be extended also, by considerate inquiry, to the sick?

SANITARY ADMINISTRATION.

SANITARY ADMINISTRATION.

At the three seats of government, Calcutta, Madras, and Bombay, sanitary powers are vested in local commissioners appointed by Government. But there appears to be no one on these commissions specially conversant with sanitary works. For in each city the sanitary state of the population, as regards drainage, water-supply, cleansing, construction of buildings, and general sanitary arrangements, is as bad as it can well be. It is hardly an exception to this, that Bombay has recently obtained, for the first time since it came under British rule, a water-supply; or that Calcutta is about to be drained, for drainage and water-supply are only two portions of one system, and not two separate systems. Nothing has yet been done in Madras. And as sanitary measures, to be effectual, must be carried out as a whole, and not partially, it cannot be said that even the seats of Government have, up to the present time, made any efficient progress in sanitary improvement.

5305. Sir C. Trevelyan states that, before he left Madras, he prepared a scheme for the reconstruction of the municipality on a sufficiently popular basis to interest the inhabitants; and through this to lay the foundation of sound sanitary improvement, by the introduction of a conjoined system of drainage and water-supply. But up to this present time nothing further has been done.

So far as the evidence before us relates to other large cities and towns, there is no sanitary administration what-

SANITARY ADMINISTRATION.

ever; so that, to all intents and purposes, this important administrative department has to be created for India.

Vide Abstract of Stational reports.

The sanitary police of bazaars is, with few exceptions, of a most inefficient character. The administration seems to vary at different places, and to be confined chiefly to surface cleansing. The power is exercised by the cantonment magistrate, but on no definite system; sometimes carts and sweepers are allowed, in other cases the people are held responsible for their own cleanliness. Certain bazaars and cantonments are described as being "clean." But the majority bear no evidence of any consistent sanitary authority being in existence.

The sanitary state of the lines is under the military authorities and medical officers. But hitherto this part of the administration has been far from efficient, on account of its not being special enough. Referring to this subject, Sir R. Martin states that, although generally throughout India the arrangements are admirable for the cure of disease, they are not at all so for the prevention of disease, that, for this great purpose, they are almost 200.
universally wanting; that there are no proper sanitary 216–218.
officers; that no knowledge whatever, either of military hygiène or of preventive science, has been exacted from medical officers; that indeed a sanitary department is altogether wanting; that any knowledge obtained by medical officers has been too often obtained at the expense of the soldier.

An examination of the stational returns shows that the 5498, 5499.
proper functions of officers of health are not even recognized, and that there is neither order nor system in the administration.

Very important improvements have been recently introduced into Her Majesty's service, which will in time remove some of the evils so far as stations are concerned. A practical school, in which hygiène is taught, is now in operation at Netley, and all candidates for commissions in the army medical service are required to undergo this course of instruction. In the present transition state of the Indian service all Indian medical officers must also attend this school. In a few years therefore the army will be supplied with a considerable number of men competent for ordinary regimental sanitary work. According to the new medical regulations, in force in Queen's regiments, medical officers have now certain defined sanitary powers in inspecting and reporting to their commanding

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officers, who are required to carry out their recommendations, or else to state their reasons for non-compliance to the superior military authority. Special sanitary officers can be appointed to this work in garrisons, camps, and stations, or, if such officers are not appointed, the principal medical officer is required to do the duty. Reports are made to commanding officers, and are dealt with as already mentioned.

2209. This procedure was in operation in India during the mutiny, and "was leading to an immense amount of good," when the service was discontinued. We are of opinion that, if the regulations were enforced at every station, they would effect all the good they are capable of, so far as the stations are concerned. These regulations, of course, are applicable only to the removal of easily-removed causes of disease. They can effect no improvement as regards drainage, water-supply, the laying out of stations and bazaars, and works generally requiring a large outlay, such as are executed under the Public Works Department.

This department at present has no special sanitary direction, and as we have shown, even the latest constructed barrack errs in the most important particulars.

Much of this evil might be avoided in time to come by requiring all cadets of engineers at Brompton to attend a special course of hygiène, which they have a right to do (by the army medical school regulations).

It follows from what has been said that, except for regimental and certain stational purposes, there is no sanitary authority or administration in India, and no means of bringing the large experience acquired in dealing with sanitary questions, as regards towns, stations, and barracks, including the description of works which have been successfully introduced at home, to bear on the Indian question. The time has now arrived to supply this deficiency in each presidency.

There are no doubt considerable difficulties in the way of organizing an efficient sanitary service for India, and in adapting it to the various exigencies of the country, but there are nevertheless certain leading principles which should be kept in view in any administrative arrangements to be introduced for the purpose. It is, for example, of great importance that the procedure should be as far as possible uniform in each presidency, and this could be best secured by appointing commissions of health, one at

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each seat of Government, representing the various elements, civil, military, engineering, sanitary, and medical, on the co-operation of which depends the solution of many health questions. We are of opinion that such commissions are necessary also to give a practical direction to sanitary improvements and works.

Their functions would be chiefly consultative and advising on all questions relating to the selection and laying out of stations, proper construction of barracks, hospitals, and other buildings, drainage, water supply, cleansing, and general sanitary supervision in stations, cities, and towns, and on the prevention and mitigation of epidemic diseases.

To fulfil the other object of taking advantage of home experience, it would be necessary to afford these commissions every needful information on the most approved and economical methods of laying out sanitary works, and in those healthy principles of construction and improvement of barracks and hospitals which have been successfully carried out in England, but which have still to be introduced into India, and adapted to the circumstances of the country. The sanitary improvements which have been recently introduced at home military stations, and which are about to be carried into effect at certain foreign stations by the War Office, as well as the improved principles of construction in barracks and hospitals now in use, were adopted on the advice of a Commission specially appointed by the War Office to inquire into the subject. The questions which arise out of the evidence from the Indian stations, are of the same nature as those which have come under the examination of, and have been dealt with by, the War Office Commission, and it would be highly advisable to make their experience available for India by adding to the existing commission an engineer and a medical officer conversant with Indian sanitary questions, or to form a similar commission in England for this object. Such a commission, if considered preferable, should include members specially conversant with recent improvements, military and civil, an engineer of Indian experience who has given attention to sanitary works, and a medical member acquainted with the sanitary question as it presents itself in India. The function of such a commission could of course be consultative only. It would simply be the medium of advising and informing the Indian Government and the presidency commissions

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on the latest improvements and on the best principles of sanitary construction. For this purpose, it might give its advice on the healthiness or otherwise of plans, and as to the sanitary details of buildings to be occupied by troops; on the best and most economical methods of water supply and drainage: it might collect and publish useful information and instructive matter regarding improvements, and it might possibly be able to give a more practical direction to the education of cadets of engineers destined for service in India, to enable them to devise works and improvements on healthy principles.

It would in no way interfere with perfect freedom of action. It would place at the disposal of the Indian Government and presidency commissions the latest experience, classify and generalise the results of their several publications in a summary form, and thus enable all to arrive at a more satisfactory decision as regards measures to be carried out for protecting the health of troops than would otherwise be possible.

As to the executive authorities by whom sanitary measures will have to be carried into effect, we apprehend that, as regards military buildings and stations, the powers should remain as at present with the department of Public Works, whose plans and proposals would have to be submitted to the presidency commissions for opinion on points affecting health.

All plans of sanitary works and improvements, which might be proposed for native towns connected with stations, should also be submitted for advice and opinion to the presidency commissions.

It would be very advisable to begin this great work with the seats of Government, and to select a few of the more important stations to be thoroughly improved as examples. This course would at once afford the necessary administrative experience, and a basis would be laid for future progress.

Much time must necessarily elapse before much progress is made, but we fear this is inevitable.

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RECAPITULATION.

Our inquiry has shown—

1. That by far the larger proportion of the mortality and inefficiency in the Indian army has arisen from endemic diseases, and notably from fevers, diarrhœa, dysentery, cholera, and from diseases of the liver.

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2. That the predisposition to these diseases is in part attributable to malaria, in conjunction with extremes of temperature, moisture, and variability.

3. But that there are other causes of a very active kind in India connected with stations, barracks, hospitals, and the habits of the men, of the same nature as those which are known in colder climates to occasion attacks of these very diseases, from which the Indian army suffers so severely.

Bad selection of stations.

In examining into these causes, we find that the stations generally have been selected without reference to health, and mainly from accidental circumstances, or for political and military reasons. Many of them are situated in low, damp, unhealthy positions, deficient in means of natural drainage, or on river banks, close to unwholesome native cities or towns.

Bad sanitary state of native towns and bazaars.

The towns and bazaars in the vicinity of lines are in the worst possible sanitary state, undrained, unpaved, badly cleansed, often teeming with offensive and dangerous nuisances; with tanks, pools, and badly-made surface gutters, containing filth and foul water; the area overcrowded with houses, put up without order or regularity; the external ventilation obstructed, and the houses overcrowded with people; no public latrines, and every spare plot of ground covered with filth in consequence; no water-supply, except what is obtained from bad shallow wells and unwholesome or doubtful tanks. These towns and bazaars are the earliest seats of epidemics, especially of cholera, before their ravages extend to the European troops in the vicinity.

Sanitary defects of stations.

None of the stations have any subsoil drainage; and there are no other means of removing the rainfall except surface gutters. The ground about the lines is often broken up in pits and hollows, filled with stagnant water, or it is traversed by unwholesome ravines or nullahs. In certain states of the weather and wind nuisance is experienced in the lines from these causes, and from the foul state of neighbouring native dwellings. Many of the older stations are irregularly built; and the buildings are arranged so as to interfere with each other's ventilation.

Defects in construction of barracks and hospitals.

Both barracks and hospitals are built at or close to the level of the ground, without any thorough draught between the floors and the ground. And the men, both in barrack rooms and sick wards, are exposed to damp and malaria from this cause, as well as from want of drainage.

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Over-crowding.

The ventilation is generally imperfect; and from the arrangement of doors and windows, men are exposed to hurtful draughts. Many of the rooms are too high, and as a consequence there is much surface over-crowding, both in barracks and hospitals, although with large cubic space. In a number of instances both the space and area per bed are much too small.

Want of light.

Barracks and hospitals have frequently no glazed windows, and only wooden shutters. Both barrack rooms and sick wards are, as a rule, dark.

Bad position of beds.

There are often four, or even six, rows of beds between the opposite doors or windows, increasing greatly the already existing difficulty of ventilation and exposing the inmates to foul air.

Barrack rooms hold too many men.

The greater proportion of the force is lodged in barracks in such large numbers per room as to be very injurious to health; many of these rooms being several hundreds of feet in length, and some of them containing from a quarter to half of a regiment each!

Defects in water-supply.

Water sources have been, with one or two exceptions, selected without analysis, although it is always hazardous to omit this precaution. The supply is taken from shallow wells and tanks, both of which are very liable to pollution. In a few cases, the water is derived from rivers. It is drawn by dipping, and carried in skins, thereby increasing its impurity. No precautions are taken for purifying drinking water, and the whole arrangement results in a supply of water (for drinking and culinary purposes) of a bad or doubtful quality, and such as would be rejected in any improved sanitary district in this country. This unsatisfactory condition of the water supply is one of the cardinal defects at Indian stations.

Deficient means of cleanliness.

Ablution and bath accommodation is often very deficient and sometimes there is none. Very often there are no baths, and where baths exist there are not enough.

Cooking.

Means of cooking are primitive and imperfect, hardly suitable for permanent barracks, although the cooking is considered sufficiently varied.

Latrines and urinals.

Privies and urinals are generally of a bad or defective construction. The contents are removed by hand, often producing great nuisance. No drainage for either privies, ablution rooms, or cook-houses: the foul water is received into cesspits or carried away by hand.

Hospital defects.

Hospitals are constructed on the same general plan as barracks. They have no proper ablution or bath accom-

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modation; no water-closets, only open privies situated at a distance; no drainage, no water supply, except what is drawn and carried by hand labour. The bedsteads are often of wood, instead of iron, and mattresses and pillows of various materials, instead of hair, as they ought to be.

No trained attendants are provided for the sick.

Ration.

The soldier has a complete ration of good quality; but the ration is not varied to provide against the effects of the soldier's sedentary habits; and no difference is made for the cold and hot season. For the hot season the ration contains too much animal food and too little vegetable. Mutton is not issued often enough.

Clothing.

Flannel underclothing would be very advantageous, and a better system of supplying boots for troops is required.

Drink. Intemperance.

The use of spirituous liquors is highly detrimental to the soldier's health in India, and is one of the chief personal habits which injure him physically and morally. Abstinence from spirits has always been attended by greatly improved health, even under circumstances otherwise unfavourable, and by diminution of crime. The only advantage of the issue of spirits in canteens is stated to be that it prevents the soldier from obtaining more unwholesome spirits in the bazaar. The moderate use of malt liquor or light wines is much less injurious to health than spirits.

Connected with habits of intemperance and want of occupation, is the prevalence of syphilis, a disease which occasions a large amount of inefficiency and invaliding.

Deficient means of instruction and recreation.

Means of recreation are few, of exercise none, of instruction limited. The soldier's habits are sedentary where they ought to be active. He is led into vice and intemperance. He has no means of occupying his time profitably. He complains of the weary sameness and ennui of his life. This, together with his diet, and allowance of spirit and malt liquor, is bad for his health—physical as well as moral health.

Results of removable causes of disease.

Making every allowance for the influence of climate, which, however, is altogether secondary, except as increasing the effect of removable causes of disease, the whole tenor of the evidence proves that the bad sanitary conditions enumerated, together with unfavourable habits as to diet, intemperance, and want of occupation, on the part of the men, are causes sufficient to account for a large part of the sickness, mortality, and invaliding occa-

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sioned by those diseases from which the army in India mainly suffers.

State of sanitary administration.

The arrangements for the prevention of disease are either non-existent or most deficient. There are no proper sanitary authorities in towns, no trained officers of health in any town or cantonment, and no means whereby the experience obtained in dealing with sanitary questions at home can be rendered available for India. Until recently, no means on the part of medical officers of receiving education in military hygiène and sanitary knowledge existed; there was no recognition of the sanitary element in the army medical service. At present there are no means of bringing trained sanitary knowledge or experience to bear on the selection of sites for stations, or on the laying out of stations or bazaars with the requisite sanitary works, or on the planning or construction of barracks and hospitals on sanitary principles.

Under the new medical regulations, medical officers are empowered to make representations regarding removable causes of disease to commanding officers, which will so far meet the requirements of regiments; but otherwise there is neither order nor system in sanitary administration.

Hill stations.

Hill stations are proposed as a means of being able at once to remove the troops from the influence of climate, malaria, and sanitary defects of stations and barracks into a healthy region. The evidence proves that these stations are useful chiefly for prevention, but not always for cure of disease; that they are suitable for children, and for healthy or ailing men, but not for unhealthy regiments, especially those suffering from bowel complaints; that about a third part of the troops might be located on hill stations, or on other high and healthy positions in rotation, with advantage to health; that although the number of stations in malarious regions should be diminished as far as practicable, and the troops removed to healthier localities, there are certain strategical points (yet undecided) which must be held, whether healthy or unhealthy, and the force on the hills must be considered as a reserve for the purposes of health.

Although several excellent hill stations are in use, they are not sufficiently convenient for many stations; and an increased number is required. Very careful examination and trial of the climates of new sites should be undertaken. The evidence farther shows that there has been great neg-

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lect of sanitary measures at existing hill stations, giving rise to serious disease and mortality.

Elevated plain stations.

Stations on the plains and slopes of India up to 1,500 feet, and on the raised coasts of the sea, are comparatively salubrious. They only require adequate sanitary arrangements.

Lowland stations.

Stations on low inundated lands are hotbeds of malaria.

Native lines.

Native lines are laid out, and huts built, without sufficient reference to health.

There is no drainage, clearing, or leveling, and little attention to cleanliness or ventilation.

Native hospitals are almost altogether wanting in means of personal cleanliness or bathing, in drainage or water-supply, in everything in short except medicine. The medical officer has no control over the patient's diet. There are no trained attendants on the sick. The evidence shows that, by management and conciliation, much might be done to improve the sanitary condition of native lines, as well as the state of native hospitals.

We have, in the course of our inquiries, endeavoured to ascertain the probable excess of mortality in the Indian army occasioned by the sanitary defects we have described, as well as the reduction of mortality which would follow on the adoption of improvements in existing stations, combined with the use of hill stations, and the abandonment of as many unhealthy localities as may be practicable. The statistical evidence shows that the mortality varies from 11½ per cent. in the most unhealthy, to about 2 per cent. in the most healthy places, even in their present unimproved state. It has been estimated that the lowest of these rates, or 2 per cent., (double the rate at home stations since the introduction of sanitary improvements,) may be taken as the possible mortality under improved sanitary conditions. 4543, 5569.

The annual death rate for the whole of India has hitherto been about 69 per 1,000. The proposed European establishment is 73,000 men, and will, at the present rate of mortality, require 5,037 recruits per annum to fill up the vacancies caused by death alone.

A death rate of 20 per 1000 would require only 1,460 recruits per annum, so that the excess of mortality is 3,570 lives per annum.

Estimating the cost of recruiting, training, and landing men in India at no more than 100*l.* per man, the excess

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of mortality will be equivalent in cost to a tax of nearly 1,000*l.* per diem, irrespective of the cost of the extra sickness indicated by a high death rate.

A careful examination of the causes of disease and of the character of the diseases prevalent at the more healthy stations, would lead us to hope eventually for a greater saving of life than we have here estimated. Causes of disease, such as exist at these stations, would, even at home, be sufficient to account for one-half of the 20 per 1,000; and if the time should ever arrive when, under the influence of improved culture, drainage, and sanitary works, India should be freed from the local malaria which exists everywhere there now, as it once did in some form or other over Europe, we may cherish the hope of realizing what statistical inquiries appear to point to, namely, that the natural death rate in times of peace of men of the soldiers' ages in India, will be no more than 10 per 1,000 per annum.

But a reduction of mortality also indicates increased physical strength and greater fitness for duty in the army generally, as well as a smaller proportion of "constantly "sick" in hospital; and hence a greater effective numerical strength.

5569. Fewer recruits would be required to supply the losses from disease, a point of very great importance, in regard to which Sir A. Tulloch states that he very much questions whether, with the mortality rate of the last 40 years, it would be possible to keep up an army of 70,000 men in India. And he says that from what he knows of recruiting, this country would not be able to fill up the gaps occasioned by death, and at the same time supply the vacancies occasioned by invaliding, and by the return of time-expired men.

Apart therefore from the question of humanity, the introduction of an efficient system of hygiène in India is of essential importance to the interests of the empire.

The following recommendations are founded on the practical conclusions at which we have arrived.

RECOMMENDATIONS.

RECOMMENDATIONS.

1. That no recruit be sent to India under 21 years of age, nor until he has completed his drill at home, and that recruits be sent direct from home to India, so as to land there early in November.

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2. That no spirits be issued to troops on board ship, except on the recommendation of the medical officer in charge.

3. That the sale of spirits at canteens be discontinued, except in specific cases on the recommendation of the medical officer, and only malt liquor or light wines allowed. That the sale of spirits in military bazaars be made illegal, and, as far as practicable, suppressed.

4. That the ration be modified to suit the season; that flannel be introduced as under-clothing, and a better system of supplying boots introduced.

5. That the means of instruction and recreation be extended to meet the requirements of each station. That covered sheds for exercise and gymnastics be provided, and that gymnastic exercises be made a parade. That libraries be improved, a better supply of books and periodicals provided, together with reading rooms, well lighted at night. That only coffee, tea, and other non-intoxicating drinks be sold to the men at these rooms. That workshops be established, and also soldiers' gardens, in connexion with the station, wherever practicable. That the proposal made by Sir C. Trevelyan of selecting and educating soldiers of good character for subordinate offices in the administrative departments be tried.

6. That until the mortality be reduced, the period of service in India be limited to 10 years.

7. That provision be made for passing invalids at the port of embarkation without delay, and for their immediate shipment home.

8. That works of drainage and water-supply be carried out at all stations. That all existing water sources be subjected to analysis, and those rejected which contain matters injurious to health. That the present method of drawing and distributing water be discontinued wherever practicable. That all water used for drinking purposes be filtered, or otherwise purified.

9. That all future barracks and hospitals be erected on raised basements, with the air circulating under the floors, and that, in all existing barracks and hospitals, the floors be raised as much as possible, and a free current of air allowed to pass beneath them.

10. That all new barracks be constructed to hold no more than a quarter company in each building, or at most half a company in one building in two separate rooms having no direct communication with each other. That

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hospitals be constructed in detached pavilions containing no more than from 20 to 24 beds. That future barracks and hospitals be arranged en échelon to receive the benefit of prevailing winds. And that detached cottages be erected for married soldiers.

11. That barracks and hospitals be in future constructed with single verandahs only; and for no more than two rows of beds between the opposite windows.

12. That the cubic space per man in future barracks be from 1,000 to 1,500 feet, and the superficial area from 80 to 100 square feet, varying according to the airiness of the position. The same space and area to be allotted in existing barracks.

13. That the beds be so arranged, with respect to windows, doors, and wall spaces as to ensure the benefit of free ventilation, without exposing the men to draughts. That, in existing barracks, where the space between the doors is too small to admit of this, precautions be taken to shelter the beds from draughts. That, in all future barracks, the wall space be made sufficient to keep the beds at the least three feet apart, and at the same time out of the door draught.

14. That the ventilation of barracks and hospitals be sufficiently provided for independently of doors and windows.

15. That in all cavalry barracks, saddlery rooms be provided, and saddles removed out of the barrack rooms.

16. That all barracks and hospitals be provided with sufficient glazed window space to light them, and that they be better lighted at night. Gas to be introduced where practicable.

17. That all barracks be provided with sufficient ablution and bath accommodation, with a constant water-supply. That drinking-fountains supplied with filtered water be provided.

18. That barrack cook-houses be improved and better ventilated.

19. That wherever practicable iron or earthenware water latrines, supplied with water, and drained to an outlet, be introduced instead of the present system; that, where this is impracticable, all cesspits be abolished, and metal or earthenware vessels, to be removed twice a day, substituted. That improved urinals, supplied with a jet for lavatory purposes, as well as with a free supply of water for the cleansing and drainage of the urinals, be provided.

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20. On the subject of venereal disease, and the means to be employed for its diminution, we refer to the suggestions made by us under that head in the body of the report.

21. That wherever there is a deficiency of married quarters, the same be supplied.

22. That the cubic space in hospitals be fixed at 1,500 feet and upwards, and the superficial area at from 100 to 120 and 130 square feet per bed, according to the healthiness of the position; and that the wall space per bed be never less than eight feet. In existing hospitals the same space and area to be allowed.

23. That every hospital be provided with a constant supply of pure filtered water, and with drainage.

24. That every hospital be provided with ablution accommodation, with fixed basins, and with baths, having hot and cold water laid on, conveniently accessible from the wards.

25. That, wherever practicable, water-closets, with drainage and water-supply, be introduced for hospital wards, and privies converted into water latrines.

26. That the hospital diet tables in use at home stations be adopted in India as far as practicable, and the hospitals supplied with properly trained cooks.

27. That trained hospital attendants be introduced into all hospitals, and that female nurses, under the new medical regulations, be introduced into large general hospitals.

28. That in future every regiment in India shall have an adequate number of hospital orderlies from its own ranks to provide personal attendance for the sick.

29. That the number of general hospitals in India be increased by the organization of such hospitals, under the new medical regulations, at the largest European stations.

30. That the strategical points of the country, which must be occupied, be now fixed, with special reference to reducing as far as possible the number of unhealthy stations to be occupied.

31. That a sufficient number of hill stations, or of stations on elevated ground, be provided; and that a third part of the force be located on these stations in rotation.

32. That the sanitary duties of regimental, garrison, and inspecting medical officers, prescribed in the new medical regulations of October 7, 1859, be applied or adapted to all stations in India. And that properly

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trained army medical officers of health be appointed to this service at the larger stations.

33. The Commission entirely approves of medical candidates being required to undergo the course of instruction, including military hygiène, at the army medical school, and are of opinion that practical training in sanitary science is of the greatest importance to the public service.

34. Considering also the constant reference to sanitary subjects necessary in carrying out public works in India, they consider it requisite that every cadet of engineers should attend a course of sanitary instruction at Chatham.

35. In order to the gradual introduction of sanitary improvements for barracks, hospitals, and stations, as well as in the seats of Government and throughout towns in proximity to military stations, they recommend the appointment of commissions of public health, one for each presidency, so constituted as to represent the various elements, civil, military, engineering, sanitary, and medical; to give advice and assistance in all matters relating to the public health, such as selection of new stations and the sanitary improvement of existing stations and bazaars; to examine new plans for barracks and hospitals; to advise on the laying out of stations and bazaars, the sanitary improvement of native towns, prevention and mitigation of epidemic diseases, and generally to exercise a constant oversight on the sanitary condition of the population, European and native; to report on the prevalence, causes, and means of preventing sickness and disease; and further, that administrative measures be adopted to give effect to the advice of the presidency commissions. That trained medical officers of health be appointed, to act in peace as in war, in connexion with these commissions.

36. That in order to render available for India the experience obtained in dealing with all classes of sanitary questions in England, two officers of the Indian Government be appointed in England to be associated with the War Office Commission for this special purpose: unless it should be thought preferable to appoint a similar commission specially for the Indian Department.

37. That a code of regulations, embodying the duties and adapted to the specialties of the Indian sanitary service, be drawn up and issued under authority.

RECOMMENDATIONS.

38. That the system of army medical statistics at present in use at home stations, be extended to all stations in India.

39. That a system of registering deaths and the causes of death be established in the large cities of India, and be gradually extended, so as to determine the effects of local causes on the mortality of the native as well as of the European population; the results to be tabulated and published annually by the Commissions.

All which we humbly certify to Your Majesty.

(Signed). STANLEY. (L.S.)
PROBY T. CAUTLEY. (L.S.)
J. R. MARTIN. (L.S.)
J. B. GIBSON. (L.S.)
E. H. GREATHED. (L.S.)
W. FARR. (L.S.)
JOHN SUTHERLAND. (L.S.)

T. BAKER, *Secretary.*

Dated 19*th May* 1863.

India Office return.

TABLES REFERRED TO IN THE FOREGOING REPORT.

TABLE 1.—MILITARY FORCE employed in INDIA in 1856 and 1861.

—	Total.		European				Native Troops.	
			Officers.		Non-commissioned Officers and Men.			
	1856.	1861.	1856.	1861.	1856.	1861.	1856.	1861.
ALL ARMS - - - - -	280,325	221,887	5,996	8,324	39,108	75,759	235,221	137,804
Engineers and Sappers - - -	3,360	3,378	237	286	161	300	2,962	2,792
Artillery - - - - -	16,390	16,502	473	804	6,729	11,816	9,188	3,882
Cavalry - - - - -	32,540	26,757	431	811	1,442	6,713	30,667	19,233
Infantry - - - -	225,772	172,201	4,053	5,573	30,400	56,310	191,319	110,318
Medical Establishment - - -	1,887	2,429	802	850	—	—	1,085	1,579
European Warrant Officers - - -	376	620	—	—	376	620	—	—

India Office return.

TABLE 2.—MILITARY FORCE employed in INDIA in 1856 and 1861.

—	Number of Regiments or Corps.		European Officers.		European Non-commissioned Officers and Men.		Native Troops.		Total.	
	1856.	1861.	1856.	1861.	1856.	1861.	1856.	1861.	1856.	1861.
ALL ARMS	—	—	5,996	8,324	39,108	75,759	235,221	137,804	280,325	221,887
Royal army	—	—	713	2,719	22,867	58,922	—	—	23,580	61,641
Company's army	—	—	5,283	5,605	16,241	16,837	235,221	137,804	256,745	160,246
Royal troops :—										
Artillery	—	22 Battalions.	—	127	—	3,958	—	—	—	4,085
Dragoons	2	8 Regiments.	47	313	1,382	5,359	—	—	1,429	5,672
Infantry	22	49 do.	666	2,279	21,485	49,605	—	—	22,151	51,884
Company's troops :—										
1. Engineers and Sappers	—	—	237	286	161	300	2,962	2,792	3,360	3,378
2. Horse Artillery	5 Brigades.	5 Brigades.	118	196	1,974	2,396	1,120*	499†	3,212	3,091
2a. European Foot Artillery	12 Battalions.	13 Battalions.	225	427	4,725	5,452	3,265‡	1,956‡	8,215	7,835
2b. Native Foot Artillery	6 do.	2 do.	130	54	30	10	4,803‡	1,427‡	4,963	1,491
3. European Cavalry	—	5 Regiments.	—	220	—	1,340	—	—	—	1,560
4. Native Regular Cavalry	21	26 do.	284	220	60	14	9,597	11,767	9,941	12,001
4a. Native Irregular Cavalry	33	16 Corps.	100	58	—	—	21,070	7,466	21,170	7,524
5. European Infantry	9	11 Regiments.	321	539	8,115	6,046	—	—	8,436	6,585
5a. Native Regular Infantry	155	126 do.	2,771	2,471	252	167	152,538	93,370	155,561	96,008
5b. Native Irregular Infantry	45	22 do.	129	115	72	22	35,312	16,948	35,513	17,085
6. Veterans	—	—	166	169	476	470	3,469	—	4,111	639
7. Medical Establishment	—	—	802	850	—	—	1,085§	1,579§	1,887	2,429
8. European Warrant Officers	—	—	—	—	376	620	—	—	376	620

* Includes 451 gun lascars.

† Includes 158 gun lascars.

‡ Includes gun lascars and ordnance drivers.

§ These are described as " apothecaries and stewards " and " native doctors."

TABLE 3.—ANNUAL COST in £ of 1,000 of the QUEEN'S TROOPS in INDIA.

Exclusive of COST of Staff Charges, Camp Equipage, Ammunition, Arms, Stores, Punkahs, Bedding, Hospital Attendants, Medicines, and Transport in India.

	Infantry.	Cavalry.	Artillery.
Strength: All ranks	1,000	1,000	1,000
Strength: Officers	37	58	32
Strength: Non-commissioned Officers and Men	963	942	968
	£	£	£
ALL RANKS	81,633	102,400	83,700
I. Officers	20,637	39,368	16,684
II. Non-commissioned Officers and Men	60,996	63,032	67,016
I. Officers :—			
Pay and allowances	17,366	34,362	13,912
Passage money	1,500	2,230	1,240
Non-effective charge	1,771	2,776	1,532
II. Non-commissioned Officers and Men :—			
1. Pay, clothing, and maintenance	43,329	45,420	48,480
2. Passage money	5,569	5,440	5,599
3. Levy money, depôt, and recruiting expenses.	4,716	4,951	5,516
4. Non-effective charge	7,382	7,221	7,421
1. Pay, clothing, and maintenance of Non-commissioned Officers and Men :—			
Pay and allowances	15,150	17,780	20,180
Victuals	8,672	8,480	8,710
Clothing	2,617	2,560	2,630
Barracks	13,150	12,900	13,200
Wives and children of soldiers, good-conduct pay, head money, lascars, &c. &c.	3,740	3,700	3,760
2. Passage money of Non-commissioned Officers and Men :—			
Passages *outwards* of relief regiments	1,509	1,477	1,518
" *homewards* of regiments recalled	1,348	1,318	1,355
" *outwards* of drafts	1,512	1,470	1,526
" *homewards* of invalids	1,200	1,175	1,200
3. Levy money, depôt, and recruiting expenses:—			
Levy money	869	1,493	1,963
Depôt and recruiting expenses for depôt of *one* company.	3,847	3,458	3,553
4. Non-effective charge of Non-commissioned Officers and Men	7,382	7,221	7,421

NOTE.—The Table may be read thus :—The cost of maintaining an infantry regiment in India of 1,000 strong is 81,633*l.*; each soldier costs 81*l.* 6·33 florins, or 81*l.* 12*s.* 8*d.* This is exclusive of the cost of the staff, of arms, ammunition, hospital supplies, &c.

TABLE 4.—AVERAGE ANNUAL MORTALITY at certain Periods of Service in the Three Presidencies of the EFFECTIVES of the European Forces of the late East India Company.

Years of Service.	Average Annual Rate of Mortality per 1,000 in 10 Years.*			
	INDIA.	Bengal.	Madras.	Bombay.
0—1 years - -	65·2	78·1	73·9	31·4
1—2 „ - -	53·6	74·0	40·7	33·4
2—3 „ - -	56·2	61·7	73·3	37·4
3—4 „ - -	49·3	54·2	28·9	66·6
4—5 „ - -	44·1	71·5	20·5	39·9
0—5 „ - -	54·6	68·7	42·9	38·4
5—10 „ - -	47·0	64·0	35·2	36·0
10—15 „ - -	52·8	69·1	43·2	45·3
15—20 „ - -	43·0	62·2	33·1	31·9
20 and upwards -	62·5	76·9	43·3	102·0
Total - -	51·2	67·2	39·5	38·4

* NOTE.—The average annual rate of mortality in the Table is for the 10 years 1847–1856 in the Bengal and Madras presidencies, and for the 10 years 1846–49 and 1851–56 in the presidency of Bombay. The rate of mortality for this period was considerably below the previous average in Madras and Bombay.

TABLE 5.—INDIA. The CASUALTIES in the EFFECTIVE NON-COMMISSIONED OFFICERS and MEN of the Local European Forces during the Years 1847–56.

Year of Service.	Strength. (Years of Life.)	Casualties.				Rate per Cent.			
		Deaths. (D.)	Invaliding. (I.)	D. + I.	All Causes.	Deaths. (D.)	Invaliding. (I.)	D. + I.	All Causes.
0—1 - -	14,390	938	45	983	1,547	6·52	·31	6·83	10·75
1—2 - -	11,630	623	88	711	1,085	5·36	·75	6·11	9·32
2—3 - -	9,220	518	83	601	872	5·62	·90	6·52	9·45
3—4 - -	9,530	470	121	591	907	4·93	1·27	6·20	9·51
4—5 - -	10,120	446	128	574	871	4·41	1·26	5·67	8·60
5—10 -	41,860	1,968	468	2,436	4,048	4·70	1·12	5·82	9·67
10—15 -	21,440	1,131	597	1,728	2,949	5·28	2·78	8·06	13·75
15—20 -	9,976	429	598	1,027	1,424	4·30	6·00	10·30	14·28
20 & upwards	3,090	193	779	972	1,207	6·25	25·21	31·46	39·06

This Table is compiled from the Tables of Casualties of Effectives in the Presidencies. Under "invalided" are included here, besides the true invalids, the following casualties :—(1.) Discharged by purchase ; (2.) Discharged on account of term expired or otherwise ; (3.) Promoted ; (4.) Transferred to town major's list ; (5.) Transferred to other corps ; (6.) Deserted ; (7.) Missing, &c. ; (8.) Other causes. Those on the town major's list of Bengal are included among the effectives.

TABLE 6.—INDIAN LIFE and SERVICE TABLES for NON-COMMISSIONED OFFICERS and MEN.

(Constructed on the Returns of the European Troops of the late Company during the 10 Years 1847–56.)

Years of Service. (x)	Living and Serving.	Decrements in the Five Years following (x)	Decrements by various Causes.								
			Died in the Service.	Invalided.	Discharged.		Promoted.	Transferred		Deserted.	Missing and other Causes.
					By Purchase.	Time expired.		to Town Major's List.	to other Corps.		
0	100,000	37,915	21,499	3,338	1,543	2,749	93	1,314	5,979	1,242	158
5	62,085	23,543	7,988	3,500	1,458	3,074	284	2,692	4,039	441	67
10	38,542	19,045	7,980	3,634	529	2,496	237	1,211	2,763	128	67
15	19,497	9,893	2,980	4,155	28	653	354	507	1,195	7	14
20	9,604	—	—	—	—	—	—	—	—	—	—
Totals	- -	90,396	40,447	14,627	3,558	8,972	968	5,724	13,976	1,818	306

TABLE 7., showing the Reduction of the CORPS of the EUROPEAN ARMY in INDIA, from ALL CAUSES, in each Year of Service from 0 to 20 :—

Year of Service. (x_i)	Serving. (l_x)	Annual Decrement. (d_x)	Probable Age.
0	100,000	10,202	21
1	89,798	7,996	22
2	81,802	7,382	23
3	74,420	6,756	24
4	67,664	5,579	25
5	62,085	4,222	26
6	57,863	4,679	27
7	53,184	4,906	28
8	48,278	4,934	29
9	43,344	4,802	30
10	38,542	4,550	31
11	33,992	4,215	32
12	29,777	3,831	33
13	25,946	3,426	34
14	22,520	3,023	35
15	19,497	2,634	36
16	16,863	2,274	37
17	14,589	1,944	38
18	12,645	1,651	39
19	10,944	1,390	40
20	9,604	1,163	41

TABLE 8., showing the Reduction of the CORPS of the EUROPEAN ARMY in INDIA, by DEATH and INVALIDING ALONE, in each Year of Service :—

Year of Service.	Serving.	DIED or INVALIDED Annually.	Probable Age.
0	100,000	6,606	21
1	93,394	5,541	22
2	87,853	5,546	23
3	82,307	4,951	24
4	77,356	4,266	25
5	73,090	4,032	26
6	69,058	3,809	27
7	65,249	3,689	28
8	61,560	3,741	29
9	57,819	3,757	30
10	54,062	3,740	31
11	50,322	3,690	32
12	46,632	3,613	33
13	43,019	3,510	34
14	39,509	3,386	35
15	36,123	3,242	36
16	32,881	3,084	37
17	29,797	2,915	38
18	26,882	2,737	39
19	24,145	2,555	40
20	21,590	2,369	41

TABLE 9., showing the Reduction of the CORPS of the EUROPEAN ARMY in INDIA, from DEATHS ALONE, in each Year of Service from 0 to 20 :—

Year of Service.	Serving.	Annual DEATHS.	Probable Age.
0	100,000	6,312	21
1	93,688	4,888	22
2	88,800	4,853	23
3	83,947	4,040	24
4	79,907	3,445	25
5	76,462	3,366	26
6	73,096	3,286	27
7	69,810	3,206	28
8	66,604	3,127	29
9	63,477	3,047	30
10	60,430	2,967	31
11	57,463	2,886	32
12	54,577	2,805	33
13	51,772	2,723	34
14	49,049	2,641	35
15	46,408	2,559	36
16	43,849	2,476	37
17	41,373	2,392	38
18	38,981	2,308	39
19	36,673	2,224	40
20	34,449	2,140	41

TABLE 10.—ANNUAL RATE of MORTALITY, in Groups of Years, from 1770 to 1856, in each of the PRESIDENCIES.

Years.	Deaths annually to 100 of Strength.			
	INDIA.	Bengal.	Bombay.	Madras.
1770–1800	5·47	7·06	7·82	3·75
1800–1810	7·37	9·15	8·45	5·48
1810–1820	8·48	6·87	9·96	9·70
1820–1830	9·07	8·45	9·79	9·52
1830–1840	5·57	6·01	4·63	5·55
1840–1850	6·54	7·95	6·83	4·35
1850–1856	5·07	6·78	3·11	4·43
1770–1800	5·47	7·06	7·82	3·75
1800–1856	**6·86**	**7·41**	**6·60**	**6·35**
1800–1830	8·46	8·06	9·54	8·43
1830–1856	5·77	6·96	5·04	4·73

TABLE 11.—INDIA.—Average ANNUAL MORTALITY per 1,000 amongst the EFFECTIVE and NON-EFFECTIVE Troops of the late East India Company (Non-commissioned Officers and Men) in 10 Years (1847–56).

Ages.	Years of Life.	Deaths.	Annual Rate of Mortality per 1,000.		Excess of the Rate of Mortality in India.
			Non-commissioned Officers and Men in India.	Males in England.	
Total - -	146,405	7,597	51·9	—	—
10— - -	3,147	83	26·4	5·2	21·2
20— - -	33,813	1,908	56·4	8·7	47·7
25— - -	46,586	2,274	48·8	9·6	39·2
30— - -	30,397	1,509	49·6	10·6	39·0
35— - -	15,953	820	51·4	11·9	39·5
40— - -	7,683	473	61·6	13·9	47·7
45— - -	3,830	220	57·4	16·8	40·6
50— - -	2,140	120	56·1	21·5	34·6
55— - -	1,225	67	54·7	27·6	27·1
60— - -	733	40	54·6	37·8	16·8
65— - -	468	44	94·0	54·8	35·2
70— - -	247	20	81·0	81·8	—
75 and upwards	183	19	103·8	121·6	—

The Table may be read thus:—In 33,813 years of life, 1,908 died of the age 20 and under 25, so the mortality was at the rate of 56·4 per 1,000; and as the mortality of men of the corresponding age in England is at the rate of 8·7, the excess of the mortality in India is 47·7 per 1,000.

TABLE 12.—LIFE TABLE for the ENGLISH SOLDIER in INDIA.

AGE.	DYING in each Year of Age.	LIVING at each Age.	SUM of the NUMBERS LIVING at each Age (x), and from x to the last Age in the Table.	LOGARITHMS of the PROBABILITY of LIVING ONE YEAR after the Age x.	LOGARITHMS of the NUMBERS LIVING at each Age.
x	d_x	l_x	L_x	λp_x	λl
20	2,052	33,361	607,084	$\bar{1}$·9724347	4·5232361
21	1,811	31,309	573,723	$\bar{1}$·9741177	4·4956708
22	1,618	29,498	542,414	$\bar{1}$·9754993	4·4697885
23	1,462	27,880	512,916	$\bar{1}$·9766063	4·4452878
24	1,336	26,418	485,036	$\bar{1}$·9774643	4·4218941
25	1,234	25,082	458,618	$\bar{1}$·9780992	4·3993584
26	1,150	23,848	433,536	$\bar{1}$·9785366	4·3774576
27	1,081	22,698	409,688	$\bar{1}$·9788022	4·3559942
28	1,024	21,617	386,990	$\bar{1}$·9789218	4·3347964
29	976	20,593	365,373	$\bar{1}$·9789211	4·3137182
30	933	19,617	344,780	$\bar{1}$·9788259	4·2926393
31	896	18,684	325,163	$\bar{1}$·9786618	4·2714652
32	861	17,788	306,479	$\bar{1}$·9784546	4·2501270
33	828	16,927	288,691	$\bar{1}$·9782300	4·2285816
34	794	16,099	271,764	$\bar{1}$·9780138	4·2068116
35	762	15,305	255,665	$\bar{1}$·9778316	4·1848254
36	728	14,543	240,360	$\bar{1}$·9777092	4·1626570
37	692	13,815	225,817	$\bar{1}$·9776723	4·1403662
38	708	13,123	212,002	$\bar{1}$·9759219	4·1180385
39	703	12,415	198,879	$\bar{1}$·9746639	4·0939604
40	685	11,712	186,464	$\bar{1}$·9738377	4·0686243
41	655	11,027	174,752	$\bar{1}$·9733829	4·0424620
42	620	10,372	163,725	$\bar{1}$·9732390	4·0158449
43	581	9,752	153,353	$\bar{1}$·9733454	3·9890839
44	540	9,171	143,601	$\bar{1}$·9736417	3·9624293
45	500	8,631	134,430	$\bar{1}$·9740674	3·9360710
46	463	8,131	125,799	$\bar{1}$·9745619	3·9101384
47	428	7,668	117,668	$\bar{1}$·9750647	3·8847003
48	396	7,240	110,000	$\bar{1}$·9755154	3·8597650
49	371	6,844	102,760	$\bar{1}$·9758533	3·8352804
50	347	6,473	95,916	$\bar{1}$·9760181	3·8111337
51	330	6,126	89,443	$\bar{1}$·9759493	3·7871518
52	317	5,796	83,317	$\bar{1}$·9755862	3·7631011
53	307	5,479	77,521	$\bar{1}$·9749480	3·7386873
54	292	5,172	72,042	$\bar{1}$·9748233	3·7136353
55	272	4,880	66,870	$\bar{1}$·9750787	3·6884586
56	252	4,608	61,990	$\bar{1}$·9755803	3·6635373
57	232	4,356	57,382	$\bar{1}$·9761947	3·6391176
58	215	4,124	53,026	$\bar{1}$·9767882	3·6153123
59	199	3,909	48,902	$\bar{1}$·9772273	3·5921005
60	189	3,710	44,993	$\bar{1}$·9773783	3·5693278
61	180	3,521	41,283	$\bar{1}$·9771076	3·5467061
62	178	3,341	37,762	$\bar{1}$·9762816	3·5238137
63	179	3,163	34,421	$\bar{1}$·9747667	3·5000953
64	183	2,984	31,258	$\bar{1}$·9724294	3·4748620
65	192	2,801	28,274	$\bar{1}$·9691359	3·4472914
66	204	2,609	25,473	$\bar{1}$·9647527	3·4164273
67	216	2,405	22,864	$\bar{1}$·9591462	3·3811800
68	185	2,189	20,459	$\bar{1}$·9615239	3·3403262
69	163	2,004	18,270	$\bar{1}$·9632785	3·3018501
70	145	1,841	16,266	$\bar{1}$·9644098	3·2651286
71	131	1,696	14,425	$\bar{1}$·9649180	3·2295384
72	122	1,565	12,729	$\bar{1}$·9648029	3·1944564
73	122	1,443	11,164	$\bar{1}$·9614970	3·1592593
74	121	1,321	9,721	$\bar{1}$·9582913	3·1207563

Table 12.—Life Table for the English Soldier in India—*cont.*

AGE.	DYING in each Year of Age.	LIVING at each Age.	SUM of the NUMBERS LIVING at each Age (x), and from x to the last Age in the Table.	LOGARITHMS of the PROBABILITY of LIVING ONE YEAR after the Age x.	LOGARITHMS of the NUMBERS LIVING at each Age.
x	d_x	l_x	L_x	λp_x	λl_x
75	119	1,200	8,400	$\bar{1}$·9548413	3·0790476
76	115	1,081	7,200	$\bar{1}$·9511367	3·0338889
77	111	966	6,119	$\bar{1}$·9471672	2·9850256
78	105	855	5,153	$\bar{1}$·9429225	2·9321928
79	99	750	4,298	$\bar{1}$·9383922	2·8751153
80	92	651	3,548	$\bar{1}$·9335660	2·8135075
81	85	559	2,897	$\bar{1}$·9284336	2·7470735
82	77	474	2,338	$\bar{1}$·9229846	2·6755071
83	69	397	1,864	$\bar{1}$·9172088	2·5984917
84	61	328	1,467	$\bar{1}$·9110958	2·5157005
85	52	267	1,139	$\bar{1}$·9046352	2·4267963
86	45	215	872	$\bar{1}$·8978169	2·3314315
87	38	170	657	$\bar{1}$·8906302	2·2292484
88	31	132	487	$\bar{1}$·8830651	2·1198786
89	25	101	355	$\bar{1}$·8751113	2·0029437
90	20	76	254	$\bar{1}$·8667581	1·8780550
91	16	56	178	$\bar{1}$·8579955	1·7448131
92	12	40	122	$\bar{1}$·8488131	1·6028086
93	8	28	82	$\bar{1}$·8392005	1·4516217
94	7	20	54	$\bar{1}$·8291475	1·2908222
95	4	13	34	$\bar{1}$·8186437	1·1199697
96	3	9	21	$\bar{1}$·8076787	0·9386134
97	3	6	12	$\bar{1}$·7962424	0·7462921
98	1	3	6	$\bar{1}$·7843241	0·5425345
99	1	2	3	$\bar{1}$·7719138	0·3268586
100	—	1	1	$\bar{1}$·7590011	0·0987724

FORMULAS. x = age ; and ω (omega) the last age of life.

$$d_x = l_x - l_{x+1}$$

$$L_x = l_x + l_{x+1} + l_{x+2} \;.\;.\;.\;.\;.\;.\;.\;.\;.\;.\; l_\omega.$$

$\dfrac{l_{x+n}}{l_x}$ = the probability that the soldier will live n years after the age x.

$\dfrac{l_x}{2} = l_{x+n}$; where n is the *probable duration of life* after the age x.

$p_x = \dfrac{l_{x+1}}{l_x}$ = the probability that a soldier will live 1 year after the age x.

$\mu_x = 1 - p_x = \dfrac{l_x - l_{x+1}}{l_x} = \dfrac{d_x}{l_x}$ = probability of dying in the year after x ; *incorrectly called, in several of the Reports on the Indian Funds, the "rate of mortality."*

$m_x = \dfrac{2d_x}{l_x + l_{x+1}}$ = rate of mortality in the year of age after x.

By the following two formulas the *mortality* can be deduced from the *probability of dying* (μ), and conversely the *probability of dying* can be deduced from the mortality (m).

$$m = \frac{2\mu}{2-\mu} \;;\; \text{and } \mu = \frac{2m}{2+m}$$

NOTE.—This Life Table from age 20 to 72 has been constructed upon the basis of the rate of mortality obtained from the tables relating to the non-commissioned officers and men (effective and non-effective) of the European troops of the late East India Company. It was found that at age 72 the λp_x of the Indian army corresponded nearly exactly with that of the English Life Table No. 3, and as the Indian facts did not extend beyond that age, the table was completed by means of the λp_x as given in the English Life Table No. 3. The col. l_x starts from the same base as the English Life Table No. 3,—at age 20,—but reduced on the assumption that 100,000 instead of 1,000,000 formed the starting point at age 0.

This Table differs from any life tables relating to Indian officers in this respect, that whereas they deal with officers residing in India, say from age 20 to 40 or 45, and then returning to live in England, this Table refers exclusively to soldiers *in India* at the later as well as at the earlier period of life.

TABLE 13.—LIFE ANNUITY TABLE for the ENGLISH SOLDIER in INDIA.

Age.	3 PER CENT.			5 PER CENT.		
x	D_x	N_x	λD_x	D_x	N_x	λD_x
20	18,471	228,458	4·2664916	12,573	128,231	4·0994501
21	16,830	209,987	4·2260891	11,238	115,658	4·0506955
22	15,395	193,157	4·1873696	10,084	104,420	4·0036239
23	14,126	177,762	4·1500316	9,077	94,336	3·9579339
24	12,996	163,636	4·1138007	8,191	85,259	3·9133509
25	11,979	150,640	4·0784278	7,407	77,068	3·8696259
26	11,058	138,661	4·0436898	6,707	69,661	3·8265358
27	10,219	127,603	4·0093891	6,080	62,954	3·7838831
28	9,448	117,384	3·9753541	5,514	56,874	3·7414960
29	8,739	107,936	3·9414387	5,003	51,360	3·6992285
30	8,082	99,197	3·9075226	4,539	46,357	3·6569603
31	7,473	91,115	3·8735112	4,117	41,818	3·6145969
32	6,908	83,642	3·8393358	3,733	37,701	3·5720694
33	6,382	76,734	3·8049532	3,383	33,968	3·5293347
34	5,893	70,352	3·7703460	3,065	30,585	3·4863754
35	5,439	64,459	3·7355225	2,775	27,520	3·4431999
36	5,018	59,020	3·7005169	2,511	24,745	3·3998422
37	4,628	54,002	3·6653889	2,272	22,234	3·3563621
38	4,268	49,374	3·6302240	2,055	19,962	3·3128451
39	3,920	45,106	3·5933086	1,852	17,907	3·2675777
40	3,590	41,186	3·5551353	1,664	16,055	3·2210523
41	3,282	37,596	3·5161358	1,492	14,391	3·1737007
42	2,997	34,314	3·4766815	1,336	12,899	3·1258943
43	2,736	31,317	3·4370832	1,197	11,563	3·0779440
44	2,498	28,581	3·3975914	1,072	10,366	3·0301001
45	2,282	26,083	3·3583959	961	9,294	2·9825525
46	2,087	23,801	3·3196261	862	8,333	2·9354306
47	1,911	21,714	3·2813507	774	7,471	2·8888032
48	1,752	19,803	3·2435782	696	6,697	2·8426786
49	1,608	18,051	3·2062564	627	6,001	2·7970047
50	1,477	16,443	3·1692725	565	5,374	2·7516687
51	1,357	14,966	3·1324533	509	4,809	2·7064975
52	1,246	13,609	3·0955654	458	4,300	2·6612575
53	1,144	12,363	3·0583144	413	3,842	2·6156544
54	1,048	11,219	3·0204252	371	3,429	2·5694132
55	960	10,171	2·9824112	333	3,058	2·5230472
56	880	9,211	2·9446527	300	2,725	2·4769366
57	808	8,331	2·9073958	270	2,425	2·4313276
58	743	7,523	2·8707533	243	2,155	2·3863330
59	683	6,780	2·8347042	220	1,912	2·3419319
60	630	6,097	2·7990943	199	1,692	2·2979699
61	580	5,467	2·7636354	180	1,493	2·2541589
62	534	4,887	2·7279058	162	1,313	2·2100772
63	491	4,353	2·6913501	146	1,151	2·1651695
64	450	3,862	2·6532796	131	1,005	2·1187469

Table 13.—Life Annuity Table for the English Soldier in India—*cont.*

Age.	3 PER CENT.			5 PER CENT.		
x	D_x	N_x	λD_x	D_x	N_x	λD_x
65	410	3,412	2·6128718	117	874	2·0699870
66	371	3,002	2·5691705	104	757	2·0179336
67	332	2,631	2·5210859	92	653	1·9614970
68	293	2,299	2·4673949	79	561	1·8994539
69	261	2,006	2·4160816	69	482	1·8397885
70	233	1,745	2·3665229	61	413	1·7818777
71	208	1,512	2·3180954	53	352	1·7250982
72	186	1,304	2·2701762	47	299	1·6688269
73	167	1,118	2·2221419	41	252	1·6124405
74	148	951	2·1708017	36	211	1·5527482
75	131	803	2·1162557	31	175	1·4898502
76	114	672	2·0582598	27	144	1·4235022
77	99	558	1·9965593	23	117	1·3534496
78	85	459	1·9308893	19	94	1·2794275
79	73	374	1·8609745	16	75	1·2011607
80	61	301	1·7865295	13	59	1·1183636
81	51	240	1·7072583	11	46	1·0307403
82	42	189	1·6228547	9	35	0·9379846
83	34	147	1·5330020	7	26	0·8397799
84	27	113	1·4373736	5	19	0·7358094
85	22	86	1·3356322	4	14	0·6257059
86	17	64	1·2274302	3	10	0·5091518
87	13	47	1·1124099	2	7	0·3857794
88	10	34	0·9902028	2	5	0·2552203
89	7	24	0·8604307	1	3	0·1170961
90	5	17	0·7227048	1	2	$\bar{1}$·9710181
91	4	12	0·5766257	1	1	$\bar{1}$·8165869
92	3	8	0·4217839	—	—	—
93	2	5	0·2577598	—	—	—
94	1	3	0·0841231	—	—	—
95	1	2	$\bar{1}$·9004334	—	—	—
96	1	1	$\bar{1}$·7062398	—	—	—

FORMULAS. i = interest of 1*l.* in one year.

$\frac{1}{1+i} = v$; and $d = 1 - v$.

v^x = the value of 1*l.* payable at the end of x years.

$D_x = v^x l_x$

$N_x = D_x + D_{x+1}$ . . . .

$\frac{N_x}{D_x} = A_x$ = the value of an annuity of 1*l.* payable at the beginning of every year of life.

$\frac{D_x}{N_x} = \frac{1}{A_x} = a^x$ = life annuity which 1*l.* will purchase.

NOTE.—This Table was formed from the col. l_x of the Life Table for the English soldier in India.

TABLE 14.—COMPARATIVE NUMBERS LIVING and DYING in each Year of Age amongst ENGLISHMEN remaining at Home, and ENGLISHMEN going to INDIA, as Soldiers and Civilians, at the Age of 20.

AGE x.	Englishmen remaining at Home.		Englishmen going to Madras as Civilians at the Age of 20.		Officers serving in India after the Age of 20.		Englishmen going to India at the Age of 20 as Soldiers.	
	Living.	Dying in the next Year.	Living.	Dying in the next Year.	Living.	Dying in the next Year.	Living.	Dying in the next Year.
15	34,429	178	34,429	178	34,429	178	34,429	178
16	34,251	193	34,251	193	34,251	193	34,251	193
17	34,058	211	34,058	211	34,058	211	34,058	211
18	33,847	232	33,847	232	33,847	232	33,847	232
19	33,615	254	33,615	254	33,615	254	33,615	254
	At Home.		Civilians in Madras.		Officers in India.		Soldiers in India.	
20	33,361	276	33,361	353	33,361	865	33,361	2,052
21	33,085	281	33,008	412	32,496	840	31,309	1,811
22	32,804	283	32,596	452	31,656	819	29,498	1,618
23	32,521	287	32,144	472	30,837	950	27,880	1,462
24	32,234	290	31,672	476	29,887	921	26,418	1,336
25	31,944	292	31,196	469	28,966	893	25,082	1,234
26	31,652	296	30,727	462	28,073	865	23,848	1,150
27	31,356	298	30,265	456	27,208	836	22,698	1,081
28	31,058	301	29,809	449	26,372	897	21,617	1,024
29	30,757	304	29,360	444	25,475	865	20,593	976
30	30,453	307	28,916	438	24,610	836	19,617	933

TABLE 15.—LIFE TABLE for PENSIONERS who have served in EAST and WEST INDIES.

AGE.	DYING in each Year of Age.	LIVING at each Age.	Sum of the NUMBERS LIVING at each Age (x), and from x to the last Age in the Table.	LOGARITHMS of the PROBABILITY of LIVING One Year after the Age x.	LOGARITHMS of the NUMBERS LIVING at each Age.
x	d_x	l	L_x	λp_x	λl_x
40	269	11,712	266,931	$\bar{1}\cdot9899345$	4·0686243
41	285	11,443	255,219	$\bar{1}\cdot9890168$	4·0585588
42	296	11,158	243,776	$\bar{1}\cdot9883312$	4·0475756
43	300	10,862	232,618	$\bar{1}\cdot9878462$	4·0359068
44	299	10,562	221,756	$\bar{1}\cdot9875305$	4·0237530
45	294	10,263	211,194	$\bar{1}\cdot9873525$	4·0112835
46	288	9,969	200,931	$\bar{1}\cdot9872809$	3·9986360
47	279	9,681	190,962	$\bar{1}\cdot9872840$	3·9859169
48	271	9,402	181,281	$\bar{1}\cdot9873306$	3·9732009
49	261	9,131	171,879	$\bar{1}\cdot9873890$	3·9605315
50	253	8,870	162,748	$\bar{1}\cdot9874280$	3·9479205
51	246	8,617	153,878	$\bar{1}\cdot9874159$	3·9353485
52	241	8,371	145,261	$\bar{1}\cdot9873214$	3·9227644
53	238	8,130	136,890	$\bar{1}\cdot9871130$	3·9100858
54	237	7,892	128,760	$\bar{1}\cdot9867592$	3·8971988
55	239	7,655	120,868	$\bar{1}\cdot9862286$	3·8839580
56	243	7,416	113,213	$\bar{1}\cdot9854897$	3·8701866
57	252	7,173	105,797	$\bar{1}\cdot9845111$	3·8556763
58	261	6,921	98,624	$\bar{1}\cdot9832613$	3·8401874
59	259	6,660	91,703	$\bar{1}\cdot9827775$	3·8234487
60	255	6,401	85,043	$\bar{1}\cdot9823750$	3·8062262
61	253	6,146	78,642	$\bar{1}\cdot9817490$	3·7886012
62	253	5,893	72,496	$\bar{1}\cdot9809030$	3·7703502
63	256	5,640	66,603	$\bar{1}\cdot9798402$	3·7512532
64	259	5,384	60,963	$\bar{1}\cdot9785639$	3·7310934
65	264	5,125	55,579	$\bar{1}\cdot9770774$	3·7096573
66	268	4,861	50,454	$\bar{1}\cdot9753841$	3·6867347
67	272	4,593	45,593	$\bar{1}\cdot9734872$	3·6621188
68	275	4,321	41,000	$\bar{1}\cdot9713900$	3·6356060
69	278	4,046	36,679	$\bar{1}\cdot9690959$	3·6069960
70	279	3,768	32,633	$\bar{1}\cdot9666080$	3·5760919
71	278	3,489	28,865	$\bar{1}\cdot9639298$	3·5426999
72	275	3,211	25,376	$\bar{1}\cdot9610646$	3·5066297
73	271	2,936	22,165	$\bar{1}\cdot9580155$	3·4676943
74	263	2,665	19,229	$\bar{1}\cdot9547860$	3·4257098
75	255	2,402	16,564	$\bar{1}\cdot9513794$	3·3804958
76	243	2,147	14,162	$\bar{1}\cdot9477988$	3·3318752
77	230	1,904	12,015	$\bar{1}\cdot9440478$	3·2796740
78	216	1,674	10,111	$\bar{1}\cdot9401294$	3·2237218
79	199	1,458	8,437	$\bar{1}\cdot9360471$	3·1638512
80	183	1,259	6,979	$\bar{1}\cdot9318041$	3·0998983
81	166	1,076	5,720	$\bar{1}\cdot9274037$	3·0317024
82	148	910	4,644	$\bar{1}\cdot9228493$	2·9591061
83	131	762	3,734	$\bar{1}\cdot9181442$	2·8819554
84	114	631	2,972	$\bar{1}\cdot9132916$	2·8000996
85	99	517	2,341	$\bar{1}\cdot9082948$	2·7133912
86	83	418	1,824	$\bar{1}\cdot9031572$	2·6216860
87	70	335	1,406	$\bar{1}\cdot8978820$	2·5248432
88	58	265	1,071	$\bar{1}\cdot8924726$	2·4227252
89	48	207	806	$\bar{1}\cdot8869322$	2·3151978
90	38	159	599	$\bar{1}\cdot8812641$	2·2021300
91	30	121	440	$\bar{1}\cdot8754718$	2·0833941
92	24	91	319	$\bar{1}\cdot8695583$	1·9588659

Table 15.—Life Table for Pensioners, &c.—*continued.*

AGE.	DYING in each Year of Age.	LIVING at each Age.	Sum of the NUMBERS LIVING at each Age (x), and from x to the last Age in the Table.	LOGARITHMS of the PROBABILITY of LIVING One Year after the Age x.	LOGARITHMS of the NUMBERS LIVING at each Age.
x	d_x	l_x	L_x	λp_x	λl_x
93	18	67	228	$\bar{1}$·8635271	1·8284242
94	14	49	161	$\bar{1}$·8573815	1·6919513
95	10	35	112	$\bar{1}$·8511247	1·5493328
96	7	25	77	$\bar{1}$·8447601	1·4004575
97	6	18	52	$\bar{1}$·8382910	1·2452176
98	4	12	34	$\bar{1}$·8317206	1·0835086
99	3	8	22	$\bar{1}$·8250522	0·9152292
100	1	5	14	$\bar{1}$·8182892	0·7402814
101	2	4	9	$\bar{1}$·8114349	0·5585706
102	1	2	5	$\bar{1}$·8044926	0·3700055
103	0	1	3	$\bar{1}$·7974655	0·1744981
104	0	1	2	$\bar{1}$·7903569	$\bar{1}$·9719636
105	1	1	1	$\bar{1}$·7831702	$\bar{1}$·7623205

NOTE.—This Table was formed from the column "Logarithms of the Value of Chance of Surviving," given in a Table relating to Pensioners who have served in East and West Indies, on pages 6 and 7 of Appendix to Report on "Charge for Non-effective Services of Troops of the Line in India."

TABLE 16.—ANNUAL RATE of MORTALITY amongst MALES of the Age x in ENGLAND and in INDIA.

Age. (x)	Deaths annually to 1,000 living.					
	Males in Healthy Districts of England.	Males in England and Wales.	Soldiers in India. .	Pensioners who have served in East and West Indies.	Madras Civil Service (1760–1853).*	Officers retired from the Indian Army.
22	7·3	8·7	56·4	—	14·0	10·8
27	8·0	9·6	48·8	—	15·2	11·3
32	8·4	10·6	49·6	—	15·5	12·2
37	8·9	11·9	51·4	—	16·3	13·6
42	9·9	13·9	61·6	26·9	17·9	15·8
47	11·6	16·8	57·4	29·2	20·4	19·6
52	14·4	21·5	56·1	29·2	25·2	24·9
57	18·5	27·6	54·7	35·8	28·4	32·0
62	28·9	37·8	54·6	43·9	29·7	41·2
67	44·4	54·8	94·0	61·0	35·7	53·5
72	67·9	81·8	81·0	89·5	50·5	79·7
77	103·7	121·6	103·8	128·6	85·0	116·0

* NOTE.—The mortality in the Healthy Districts, and amongst the Pensioners and Madras Civil Service has been deduced from the respective Life Tables by the formula $m_x = \frac{2 d_x}{l_x + l_{x+1}}$ The mortality of England and Wales is taken from the English Life Table, No. 3, and for Soldiers in India from the Tables published in the Addenda to Evidence. The mortality of Officers retired from Indian army has been obtained from a Table in the Statistical Journal for 1838 (vol. i. p. 280), by the formula $m = \frac{2\mu}{2-\mu}$

(*a*) Extract from the Registrar-General's Annual Summary of the London Tables of Mortality, 1859, referred to in section 12.

It may be instructive to compare the fatality by some of the diseases of London now (1859) and in the seventeenth century. In the twenty years, 1660–79, the mortality in Southwark and in the City within and without the walls was at the rate of 7 or 8 per cent.; so the mortality within the bills may be set down at the rate of 7,000 annually in every 100,000 living, of which 3,400 were by zymotic diseases.

The diseases are not always distinguished accurately. But by putting them in groups, any fallacy from this source will be obviated, and the decrease of some of the worst forms of mortal disease will be placed beyond doubt. To render the comparison easy, the number living is taken to be the same in the two periods, 100,000 in 1660–79 and in 1859. The annual deaths by small-pox were 357 in the first period, 42 in the second period; by measles 40 and 47 in the two periods. Medical science was imperfect, and the science existing in that century was very imperfectly applied. Croup and scarlatina were not generally recognized, but were confounded with measles and fever. The mortality by fever, continued or remittent, and ague was at the rate of 749 and 59 in the two periods; or including scarlatina, quinsy, and croup, the mortality was 759 and 227. Thus a person was in four times as much danger of dying of these diseases at the Restoration as a person living in London now. Women are not yet entirely exempt from peril in child-bearing; the mortality by that disease is now 17, it was then 86. Again a few (8) in 100,000 die now of dysentery; then, out of the same number, 763 died annually of that disease. By diarrhœa, a milder form of disease, 11 died then, 120 die now; cholera was fatal in 1859 to 7, and in the 20 years (1660–79) to 130 annually. Syphilis was twice as fatal as it is, the numbers being 21 and 12. Scurvy and purpura bear testimony to the imperfect nutrition of the population; the annual deaths were then 142 and are now 2. Vegetables, fruit, and fresh meat could with difficulty be procured in winter. Worms and all parasitic creatures that crawl over, bite, and prey on the body of man, were prevalent; 10 deaths were ascribed to worms.

Dropsy, a frequent result and sign of scurvy and fever, was exceedingly fatal; 298 died of that disease then, and 26 now. Apoplexy, paralysis, epilepsy, affections of the brain, and suicide, are more fatal now, according to the returns, than they were in the proportion of 57 then to 151 now.

Consumption and diseases of the breathing organs were uncommonly fatal; 1,079 then and 611 now are the figures of the mortality. Diseases of the digestive organs were fatal then and now in the proportion of 146 and 95. Stone and diseases of the urinary organs are now as fatal as they were then; the deaths being 21 and 30. Children were rapidly cut down; of convulsions and teething, 1,175 died then, 136, too many, now.

Of the violent deaths, some are now more frequent, as the forces by which they are occasioned are greater; of fractures and wounds 19 died then, 25 now; of poison, more accessible, 2 now and then only 1; of burns, as fires are probably more common, and dresses more inflammable, now 13, then 3; drowning and suffocation were then twice as fatal (23 and 20) as they are (10 and 10) in the present day.

Five in 100,000 of the people were executed then annually; now one in the whole population.

In addition, the inhabitants of London were then destroyed by the terrible plague; which, upon an average of the 20 years, carried off 1,132 lives.

In 1665 nearly a third of the population perished by plague. It is difficult to conceive this frightful destruction of human life; the imagination, the wailing notes of writers, the details of Defoe in a work which would have immortalized any writer, fail to bring all the horrors before our minds.

The mortality was at the rate of *seven* per cent. on an average during the 20 years. If the mortality of London had been at the same rate in the last year, instead of 61,617 about 194,204 deaths would have been registered.

The plague was the more appalling as the mortality overwhelmed the people in particular years; thus the burials from 15,356 in 1663, rose to 97,306, "whereof 68,596 were by plague," in 1665; and this was equivalent to more than 600,000 deaths by plague in the present population of London. In the third week of September 8,297 deaths were registered, which represents a rate of mortality equivalent to about 85,000 deaths in a week on the actual population of London.

In these recurring plagues vast numbers of people fled in panic terror from the fatal city; servants and workpeople were discharged in great numbers; commerce was paralyzed; few ships ventured up the river, and merchant vessels were occupied by their owners as asylums on the water. Sextons, gravediggers, bearers, bellmen, and drivers of death-carts were in demand. The dead were buried indiscriminately; some bodies lay in forsaken houses, others across the paths in the streets, no longer traversed by carts or coaches. At the end of the summer, grass was growing in Bishopsgate-street and Cornhill, where the people thronged no longer. The loud voices, shrieks, and sobs of the delirious, the desolate, and the dying were heard in the streets; at times too disturbed by reckless revellers, and by raving patients, who had escaped from their dwellings, converted into prisons. For according to the regulations "infected houses" were shut up; a red cross and "Lord have mercy upon us!" were inscribed on their portals; while watchmen jealously guarded the doors. These quarantine regulations were at first rigidly carried out, and were only gradually abandoned when they were found useless, pernicious, and impracticable.

It is of some use to ask whether these past occurrences possess merely a historical interest for the inhabitants of London. Are the diseases of those times ever likely to recur? The answer must be:— undoubtedly they will recur, if their causes come again into action; and not otherwise. If a comet—if the stars—if volcanic action—if some mystical telluric influence destroyed the population of London at the rate of 7 per cent. annually, and at times in paroxysms at the rate of 20 and 30 per cent. in a single year, such powers are evidently beyond the reach of the will, and of all human effort. The population must resign itself to its fate. Vesuvius may perhaps be extinguished artificially; but the cause of the volcanic action which pervades the world is inaccessible.*

All the evidence, however, goes to show that comets, stars, and volcanic action had as much to do with the mortality of the population of London in the seventeenth century as with the mortality of the British troops in the Crimea; and no more. The supply of food, and particularly of vegetable and fresh animal food, in certain seasons of the year, was defective, so that a large portion of the population became scorbutic. The houses were nearly as close and dirty as the houses now are in Constantinople and Cairo; the water supply was imperfect, as London Bridge works and Hugh Middleton's New River were for many years unappreciated. Water has in itself little attraction for people unaccustomed to ablution. Parasitic insects and diseases of the skin betrayed its impurities. The dirt of the houses struck foreigners. The sewers were imperfect; and the soil gave off marsh malaria in some parts, and in others was saturated with the filth of successive generations.

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* See the "History of Epidemics" by Hecker, and the ingenious book of Mr. Parkin.

The high rates of mortality which then prevailed still attend cholera and current epidemics in certain localities. The nature of disease and the climate are still the same as they were in London before the Revolution; and it is evident that if plague has disappeared, other zymotic diseases, but notably dysentery, scurvy, and fever, have declined. Cholera was on an average then as fatal as it has been recently, and probably much more fatal than it will be again if London be supplied with pure water.

The nation exults justly in the progress of its manufactures. But the progress of its manufactures is surpassed by the progress of the health of its capital.

The improvement in the health of London has proceeded step by step with the amendment of the dietary, the drainage of the soil on which the houses stand, the purification of the water which the people drink; with the sweetening of the air; and with the progress of medical science, which is the source of sound sanitary doctrines.

So long as these improvements are maintained, the diseases of the seventeenth century will not recur; and all further progress is in the hands of the people. They can work out their own salvation, with God's blessing. The causes of disease are numerous; but every one that has hitherto been discovered can be to a certain extent controlled. If by persevering in the exact observation and analysis of the diseases of the population, science succeeds in bringing to light the evils of unnatural diseases still existing, we may hope confidently that those evils will be averted; and that, rising from the Thames, the site of London, which was pronounced in the seventeenth century a field of blood and terror, will be a field of health, concourse, and security to the population of the Metropolis of the Empire.

TABLE 17.—ANNUAL RATE of MORTALITY per 1,000 among OFFICERS of the INDIAN ARMY.

Ages.	Colonel Henderson (1814-1833).			Ages.	Mr. Neison (1800-1847).	Mr G. Davies (1760-1839).
	Years of Life in the Service.	Deaths.	Mortality per 1,000.			
18—	9,122	205	22·73	15—	14·59	26·49
20—	20,830	603	29·37	20—	23·51	27·18
25—	16,731	540	32·80	25—	25·33	28·39
30—	12,329	429	35·41	30—	28·18	30·76
35—	9,635	371	39·26	35—	29·06	33·42
40—	6,770	268	40·39	40—	30·15	37·06
45—	3,088	141	46·72	45—	38·65	41·45
50—	1,725	73	43·22	50—	30·27	—
55—	963	43	45·65	55—	42·90	—
60—	723	36	51·06	60—	40·00	—
65—	506	39	80·08			
70—	180	20	117·65			

TABLE 18.—MORTALITY per Cent. in the following Periods of Years among those Officers in the Bengal Army who have received their Appointments during the present Century. (Constructed from Henderson and Neison's Tables. *See* Neison's Report on Bengal Military Fund, p. 11.)

Ages.	Mortality per Cent.		
	1800–19.	1820–39.	1840–47.
15—	1·591	1·354	1·128
20—	2·303	2·038	2·492
25—	2·019	2·444	3·226
30—	3·102	2·282	3·389
35—	1·787	2·630	3·137
40—	- -	2·455	3·586
45—	- -	3·026	4·364
50—	- -	4·289	2·732
55—	- -	3·999	4·720
60—	- -	- -	4·013

TABLE 19.—MORTALITY amongst OFFICERS who entered the MADRAS MILITARY FUND, from 1808 to 1857, including those who continued Members after Retirement.

Ages.	Years of Life.	Deaths.	Mortality per Cent.
14—	4,835	142	2·937
20—	16,013	531	3·316
25—	25,848	834	3·226
35—	13,783	403	2·994
45—	7,137	196	2·746
55—	2,614	78	2·983
65—	933	49	5·252
75—	146	17	11·645
85—	4	1	25·000

The Table may be read thus :—At the age 25–35, out of 25,848 years of life, there were 834 deaths, or 3·226 per cent., amongst the OFFICERS of the Madras Military Fund, from 1808 to 1857.—(Facts supplied by Mr. SAMUEL BROWN.)

TABLE 20.—MORTALITY amongst the WIVES of OFFICERS in the MADRAS ARMY, 1808 to 1857 inclusive.

Ages.	Years of Life.	Deaths.	Mortality per Cent.
15—	879	17	1·934
20—	3,946	68	1·723
25—	9,435	117	1·240
35—	5,337	73	1·368
45—	2,059	18	·874
55—	511	7	1·370
65—	—	—	—
75—	—	—	—
—	—	—	—

TABLE 21.—MORTALITY amongst the WIDOWS of OFFICERS in the MADRAS ARMY from 1808 to 1857 inclusive (chiefly in England).

Ages.	Years of Life.	Deaths.	Mortality per Cent.
15—	32	—	—
20—	·273	2	·733
25—	1,771	27	1·525
35—	2,547	30	1·178
45—	2,019	35	1·733
55—	1,253	22	1·756
65—	408	17	4·166
75—	59	7	11·864
—	—	—	—

TABLE 22.—MEAN AFTER LIFETIME (Expectation of Life) of MALES at the Age x in ENGLAND and in INDIA.

Age. (x)	Healthy Districts of England.	All England.	Madras Civil Service.	Officers serving in India. (Colonel Henderson.)	Soldiers in India.	Pensioners who have served in East and West Indies.
	Years.	Years.	Years.	Years.	Years.	Years.
20	43·40	39·48	37·02	24·04	17·70	—
25	39·93	36·12	34·40	22·30	17·78	—
30	36·45	32·76	31·92	20·81	17·08	—
35	32·90	29·40	29·29	19·38	16·20	—
40	29·29	26·06	26·56	17·97	15·42	22·29
45	25·65	22·76	23·82	16·59	15·07	20·08
50	22·03	19·54	21·11	15·12	14·32	17·85
55	18·49	16·45	18·59	13·24	13·20	15·29
60	15·06	13·53	16·04	10·88	11·63	12·79
65	12·00	10·82	13·21	8·55	9·59	10·35
70	9·37	8·45	10·31	6·73	8·33	8·16
75	7·15	6·49	7·58	—	6·50	6·40
80	5·37	4·93	5·29	—	4·95	5·04

Formula: $\frac{L_x}{l_x} - \cdot 5 =$ the *mean after lifetime* at the age x. This is sometimes called the *expectation of life—vie moyenne*—or *mean duration of life.*

NOTE.—The mean after lifetime of Soldiers in India and of Pensioners in East and West Indies is deduced from the two Life Tables (Tables 12 and 15). For the Madras Civil Service it is deduced from a Table given by Mr. Neison on page 9 of his "Report on the Madras Civil Fund."

The Table may be read thus:—The mean after lifetime of a male aged 20 would be, in the Healthy Districts, 43·40 years; in All England, 39·40 years; in the Madras Civil Service, 37·02 years; and for Soldiers in India, 17·70 years. At age 40 the mean after lifetime is 29·29 years in Healthy Districts; 26·06, in All England; 26·56, in the Madras Civil Service; 22·29 amongst Pensioners who have served in East and West Indies; and 15·42 amongst Soldiers in India.

At age 60 the members of the Madras Civil Service have the advantage of 1 year in their mean after lifetime over the males in the Healthy Districts, and of 2½ years over the males of All England.

TABLE 23.—ANNUAL PREMIUM which will insure £100, over the whole Term of the Life of a MALE aged *x* in ENGLAND and in INDIA (the latter deduced from the Life Table for the English Soldier in India).

Age (*x*)	3 per Cent.		5 per Cent.	
	England.	India.	England.	India.
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
20	1 12 5	5 3 5	1 6 2	5 0 10
25	1 16 7	5 0 9	1 9 10	4 16 11
30	2 1 8	5 4 9	1 14 4	5 0 8
35	2 8 1	5 10 6	2 0 2	5 6 5
40	2 16 2	5 16 1	2 7 9	5 12 0
45	3 6 8	5 16 9	2 17 9	5 11 7
50	4 0 5	6 1 3	3 11 0	5 14 10
55	4 18 6	6 10 7	4 8 8	6 2 10
60	6 3 3	7 8 4	5 13 1	6 19 6
65	7 17 7	9 2 1	7 7 3	8 13 7
70	10 4 7	10 8 5	9 14 1	9 18 0
75	13 7 3	13 7 6	12 16 6	12 18 1
80	17 8 4	17 8 3	16 17 1	17 10 2

Single premium to insure 100*l.* payable at the death of a male aged 20 in England and in India.

		3 per cent.	5 per cent.
		£ *s.* *d.*	£ *s.* *d.*
Age 20	England -	35 14 11	21 11 2
	India -	63 19 6	51 8 8

Formulas :—

$\pi_x = a_x - d$ = annual life premium to insure 1*l.* payable at the end of the year in which death takes place.

$\Pi_x = 1 - dA^x$ = single premium to insure 1*l.* payable at the death of the insured.

TABLE 24. — ANNUAL PREMIUM which will insure £100 over the WHOLE TERM of LIFE of a MALE aged *x*, in ENGLAND and in INDIA (*expressed according to the Decimal System*).

Age (*x*)	3 per Cent.		5 per Cent.	
	England.	Soldiers in India.	England.	Soldiers in India.
	£ fl. mils.	£ fl. mils.	£ fl. mils.	£ fl. mils.
20	1 6 20	5 1 71	1 3 09	5 0 42
25	1 8 29	5 0 36	1 4 91	4 8 44
30	2 0 84	5 2 37	1 7 18	5 0 32
35	2 4 04	5 5 26	2 0 10	5 3 19
40	2 8 10	5 8 05	2 3 89	5 6 01
45	3 3 33	5 8 36	2 8 87	5 5 79
50	4 0 20	6 0 64	3 5 50	5 7 42
55	4 9 26	6 5 30	4 4 35	6 1 43
60	6 1 64	7 4 18	5 6 56	6 9 75
65	7 8 80	9 1 06	7 3 63	8 6 79
70	10 2 28	10 4 20	9 7 04	9 9 01
75	13 3 62	13 3 74	12 8 26	12 9 06
80	17 4 16	17 4 12	16 8 55	17 5 10

This Table may be read thus :—The rate of premium on a life aged 20 is 1*l.* 6 florins 20 mils in England, and 5*l.* 1 fl. 71 mils. in India. *The latter may be read as* 51·71 *rupees.*

TABLE 24 *a*.

The following are the INDIAN PREMIUMS charged by the ALBERT and MEDICAL INSURANCE OFFICE.

Age.	Without Profits.	
	Civil.	Military.
	£ *s.* *d.*	£ *s.* *d.*
20	3 0 9	3 10 0
30	3 12 0	4 0 0
40	4 10 0	4 14 0
50	5 18 0	6 2 0
60	8 6 0	8 10 0

TABLE 25.—PRESENT VALUE of an ANNUITY of £1 on the Life of a MALE aged x, in ENGLAND and in INDIA.

Age (x)	3 per Cent.		5 per Cent.	
	England.	Soldiers in India.	England.	Soldiers in India.
20	22·06	12·37	16·47	10·20
25	21·09	12·58	15·99	10·41
30	20·01	12·27	15·43	10·21
35	18·81	11·85	14·77	9·92
40	17·47	11·47	13·98	9·65
45	16·01	11·43	13·07	9·67
50	14·42	11·14	12·03	9·52
55	12·76	10·59	10·87	9·17
60	11·02	9·68	9·60	8·52
65	9·27	8·32	8·25	7·44
70	7·61	7·50	6·91	6·82
75	6·14	6·14	5·69	5·66
80	4·92	4·92	4·63	4·49

TABLE 26.—COMPARATIVE ANNUAL PER-CENTAGE of MORTALITY of the OFFICERS of the THREE ARMIES of BENGAL, MADRAS, and BOMBAY.*

PRESIDENCY.	Colonels.	Lieut.-Colonels.	Majors.	Captains.	Lieutenants.	Cornets and Ensigns.	Surgeons.	Assistant Surgeons.	Total or General Per-centage.	General Average.
Bengal - - - - -	5·94	4·84	4·10	3·45	2·75	2·34	- -	- -	3·12	3·85
Madras - - - - -	5·40	6·11	5·42	5·02	4·17	3·80	4·68	4·31	4·49	
Bombay - - - - -	5·74	5·45	3·77	3·78	3·96	3·15	4·08	4·21	3·94	
Mean age at death of Bengal Officers -	61	51	40	36	18 to 33					

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* Asiatic Researches, vol. 20, p. 201.

TABLE 27.—TABLE of GOVERNORS-GENERAL of INDIA, showing at the Date of assuming the Government the Number of Years they were expected to live by the English Life Table, and the Number of Years they actually enjoyed. Their Years of expected Lifetime were 295 Years ; they actually enjoyed 286 Years, and adding *nine*, the expectation of the surviving Governor-General, this also amounts to 295 Years. The mean Lifetime on assuming the Government was 21 Years by the Table ; or the average number of Years which they afterwards actually enjoyed.

GOVERNORS-GENERAL.	Born.	Assumed the Government.	Quitted the Government.	Died.	Years of Lifetime after assuming Government.		
					Ex-pected.	En-joyed.	Dif-ference.
Warren Hastings* - - -	Dec. 6, 1732	April 13, 1772	Feb. 1, 1785	Aug. 22, 1818	27	46	+19
Lord Cornwallis - - -	Dec. 31, 1738	Sept. 12, 1786	Oct. 28, 1793	Oct. 5, 1805	21	19	— 2
Lord Teignmouth (Shore) - -	Oct. 8, 1751	Oct. 28, 1793	Mar. 12, 1798	Feb. 14, 1834	25	40	+15
Marquis Wellesley (Mornington) -	June 20, 1760	May 17, 1798	July 30, 1805	Sept. 26, 1842	28	44	+16
Lord Minto - - - -	April 23, 1751	July 31, 1807	Oct. 4, 1813	June 21, 1814	16	6	—10
Marquis of Hastings (Moira) - -	Dec. 7, 1754	Oct. 4, 1813	Jan. 9, 1823	Nov. 28, 1826	15	13	— 2
Lord Amherst - - -	Jan. 7, 1773	Aug. 1, 1823	Mar. 10, 1828	1857	20	34	+14
Lord Wm. Bentinck - - -	Sept. 1, 1774	July 14, 1828	Mar. 20, 1835	June 17, 1839	18	10	— 8
Lord Metcalfe † - - -	Jan. 30, 1785	Mar. 20, 1835	Mar. 4, 1836	Sept. 5, 1846	20	11	— 9
Lord Auckland - - -	Aug. 25, 1784	Mar. 4, 1836	Feb. 28, 1842	1849	19	13	— 6
Earl of Ellenborough - - -	Sept. 8, 1790	Feb. 28, 1842	June 15, 1844	(living 1863)	19	20	+ 1
Viscount Hardinge - - -	Mar. 30, 1785	July 23, 1844	Jan. 12, 1848	1856	14	12	— 2
Marquis of Dalhousie - - -	April 22, 1812	Jan. 12, 1848	1856	1860	29	12	—17
Earl Canning - - - -	Dec. 14, 1812	1856	1861	1862	24	6	—18

* Warren Hastings first went to India in 1750, after which he lived 68 years.

† Lord Metcalfe arrived at Calcutta on January 30th, 1801, nearly 16 years of age, when his expected lifetime at that age was 42. He lived in India 35 years, and 10 years longer in England, Jamaica, and Canada.

Table 28.—Comparative Table showing the Sickness, Mortality, and Invaliding in the East India Company's Troops (Natives and Europeans) in each of the Presidencies during the Years 1825–1844.*

Presidency.	Europeans or Natives.	Years of Life, or aggregate Strength (1825–44).	Admissions into Hospitals during the Years 1825–44.	Deaths from all Causes.	Deaths from Cholera.	Invalids.	Ratio per Cent. of ordinary Deaths to Strength.	Ratio per Cent. of Cholera Deaths to Strength.	Ratio per Cent. of Total Deaths to Strength.	Ratio per Cent. of Number invalided.
Total of three Presidencies - - - -	Europeans	240,577	382,600	13,012	1,741	6,939	4·685	0·724	5·409	2·884
	Natives -	3,881,660	2,591,107	69,973	13,260	75,077	1·461	0·342	1·803	1·934
Madras - - -	Europeans	101,210	135,720	3,892	432	2,101	3·419	0·427	3·846	2·076
	Natives -	1,196,260	904,325	25,064	6,976	23,479	1·512	0·583	2·095	1·963
Bombay - - -	Europeans	50,987	88,720	2,589	288	1,611	4·513	0·565	5·078	3·160
	Natives -	638,975	586,047	8,251	1,796	21,155	1·010	0·281	1·291	3·311
Bengal - - -	Europeans	88,380	158,160	6,531	1,021	3,227	6·230	1·150	7·380	3·600
	Natives -	2,046,425	1,100,735	36,658	4,488	30,443	1·570	0·220	1·790	1·500

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* Paper by Colonel Sykes in the Statistical Journal, vol. x., p. 100.

TABLE 29.—CONJUGAL CONDITION of BRITISH-BORN SUBJECTS in INDIA.—Proportion per Cent. of Married, Unmarried, and Widowers, at each Age.

Ages.	Royal Troops.						East India Company's Troops.			Civilians and Civil Population.		
	Officers.			Soldiers.								
	Married.	Unmarried.	Widowers.	Married.	Unmarried.	Widowers.	Married.	Unmarried.	Widowers.	Married.	Unmarried.	Widowers.
Total of 20 and upwards.	19·2	77·5	3·3	6·5	93·0	·5	28·8	69·3	1·9	45·4	50·1	4·5
20— - -	2·8	97·2	—	1·7	98·2	·1	5·1	94·9	—	12·7	86·9	·4
25— - -	13·0	86·1	·9	6·9	92·7	·4	19·2	79·7	1·1	31·8	66·7	1·5
30— - -	29·2	69·2	1·6	15·7	83·0	1·3	36·9	61·5	1·6	51·8	44·6	3·6
35— - -	42·5	50·2	7·3	21·9	75·1	3·0	53·2	43·5	3·3	66·1	29·2	4·7
40— - -	49·2	39·9	10·9	18·9	75·9	5·2	71·9	24·1	4·0	70·5	21·7	7·8
45— - -	55·2	27·6	17·2	10·7	75·0	14·3	77·5	14·5	8·0	72·3	18·0	9·7
50— - -	55·9	20·6	23·5	—	—	—	72·3	13·7	14·0	73·8	14·1	12·1
55— - -	53·8	23·1	23·1	—	—	—	88·1	4·8	7·1	71·9	13·2	14·9
60— - -	66·7	33·3	—	—	—	—	79·5	7·7	12·8	72·8	10·2	17·0
65— - -	33·3	44·5	22·2	—	—	—	73·7	10·5	15·8	72·5	6·9	20·6
70— - -	—	—	—	—	—	—	100·0	—	—	61·8	2·9	35·3
75 and upwards -	—	—	—	—	—	—	—	—	100·0	58·3	12·5	29·2

NOTE.—The Table may be read:—of 100 officers 20 and under the age of 25, there were 2·8 married, 97·2 unmarried.

TABLE 30.—ANNUAL RATE of MORTALITY amongst CHILDREN in INDIA and in ENGLAND.

Ages.	Children of English Officers in India.* (Facts supplied by Major-General Hanyngton.)			Annual Rate of Mortality per Cent. amongst Children of English Officers in Madras.* (Facts supplied by Mr. Samuel Brown.)		Annual Rate of Mortality per Cent.	
	Years of Life.	Deaths.	Annual Rate of Mortality per Cent.	Boys.	Girls.	Healthy Districts.	England.
Under 5 years -	21,019	1,384	6·585	3·589	3·604	4·036	6·738
5 and under 10 -	11,424	72	·630	·530	·568	·688	·916
10 „ 15 -	6,682	40	·599	·234	·319	·431	·527

* Many of the children proceed to England at about the age of five years.

Table 31.—Mortality amongst 2,993 Sons of Officers in the Madras Army, from 1808 to 1857 inclusive, including 749 who became Annuitants.

Ages.	Years of Life.	Deaths.	Mortality per Cent.
0	1,399	134	9·578
1	2,618	152	5·806
2	2,425	56	2·311
3	2,292	32	1·396
4	2,188	18	·823
5–10	9,426	50	·530
10–15	7,272	17	·234
15–21	5,968	39	·654
Total -	33,602	498	1·482

Table 32.—Mortality from 1808 to 1857, amongst 2,884 Daughters of Officers in the Madras Army, including 774 who became Annuitants.

Ages.	Years of Life.	Deaths.	Mortality per Cent.
0	1,348	110	8·160
1	2,305	137	5·943
2	2,325	62	2·667
3	2,187	32	1·463
4	2,074	28	1·350
5	8,975	51	·568
10	6,899	22	·319
15	4,879	27	·353
20	2,294	16	·697
25	1,004	6	·598
30	510	2	·392
35	279	2	·717
40	163	1	·613
45	84	1	1·190
50	36	1	2·777
55	15	1	6·666

PRÉCIS OF EVIDENCE

TAKEN BEFORE HER MAJESTY'S COMMISSIONERS APPOINTED TO INQUIRE INTO THE SANITARY STATE OF THE ARMY IN INDIA,

ARRANGED

To serve as an Analytical Index under the following Heads:

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Healthiness or otherwise.—Climate.—Drainage.—Sources of Malaria.—Means adopted for Selection of Sites.

II. BARRACK AND HOSPITAL ACCOMMODATION; [p. 210 *post*].

Construction and Materials.—Ventilation.—Cubic Space.—Repairs.—Removal of Nuisances.—Sanitary Police.—Means provided for Ablution.

III. IMPROVED TENTS; [p. 220 *post*].

For Troops on the March.—For Temporary Residence.

IV. SUPPLY OF WATER; [p. 220 *post*].

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V. COMMISSARIAT ARRANGEMENTS; [p. 224 *post*].

Ration of the Soldier.—Articles supplied.—Cooking Arrangements. — Intemperance. — Beer and Spirits.

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PRÉCIS.

I.—SANITARY DESCRIPTION OF MILITARY STATIONS IN INDIA.

SANITARY DESCRIPTION OF STATIONS.

Sir RANALD MARTIN—, describes the stations as selected without care, comprising every variety of climate, often unhealthy, under malarious influences, damp, ill drained, and some of them subject to floodings. P. 1, Q. 6–11. The majority of old stations have been selected by generals of division, presumptively on strategic grounds, but often by chance. P. 4, Q. 88–93.

Colonel SWATMAN—, considered the stations generally were selected with a view to military arrangements. They vary much as to healthiness. Agra, which was formerly healthy, was now the contrary; it was damp from water lying about during the rains. Dacca, occupied by natives, was unhealthy. Meanmeer was more healthy, being removed from a dirty city; it has also been drained. At Peshawur the troops suffered it was thought from irrigation. Surface cleansing and removal of nuisances is attended to now as a general practice. The regimental bazaars are in the rear of the cantonments, and looked after by the quartermaster, but there are no special regulations regarding their cleanliness. P. 41, Q. 303–415. The selection of a new station would usually be left to the quartermaster-general, with an engineer and a medical officer. P. 46, Q. 511–516.

Mr. A. STEWART—, describes Cawnpore as tolerably healthy during three or four cold months of the year, but very severe at other times. It was very unhealthy from 1842 to 1845. The soil is sandy, hot winds prevail, and the temperature is very high. It lies flat about a quarter of a mile from the Ganges, and liable to be annually overflowed to a great extent on one side, when, being generally ill-drained, the water is apt to lodge a good deal. There is much irrigation at some distance from the cantonments, which are at some distance from the native town. The sanitary arrangements were extremely imperfect. There is much broken ground,—ravines,—in the neighbourhood, usually in a filthy state; and the river during the rains rises to four times its ordinary width on the side opposite the cantonments. The subsoil is red sand mixed with clay. Water disappears rapidly from the surface. The latrines (open cesspits) were sometimes exceedingly offensive; the soil was removed by carts at night. There is a plentiful supply of good water from wells. P. 53, Q. 636–653. Meerut is more healthy than Cawnpore, more favourable for drainage though flat, and in a much better climate; as stations go, one of the best in India. P. 56, Q. 695–703. Umballa is a good station, soil light, sandy, with clay, partially drained, but rather flat; it is liable to inundations, from which the troops suffer. On one occasion an overflow of this kind was followed by much cholera and fever. P. 59, Q. 744–749. Kirkee, with all its disadvantages, is the healthiest station he ever occupied; the natural drainage is favourable; soil partly black; 1,855 feet above the sea. P. 59, Q. 756–761. Of late years there has been more attention paid

[N.B.—See note p. 201 *ante.*]

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to surface cleansing in the cantonments than formerly ; still, in addition to the latrines, there is a good deal of offensiveness. There are certain regulations, but they are not always carried out. Commanding officers cannot act where expense is involved. Thinks a sanitary officer, *with authority to act*, would be very useful. P. 60, Q. 769–779. General sanitary arrangements, levelling of the ground, sewerage, &c., are required at all the stations. P. 63, Q. 807–808.

Lieutenant-Colonel GALL—, considers Kirkee a comparatively healthy station ; it is a small station, having generally one regiment of cavalry only. There might be two if the barracks were good. They are very bad now. Water is scarce, so that wells must be dug, which would be expensive ; the soil is rocky ; the river is at some distance for drinking-water. P. 76, Q. 898–903. Kirkee is well drained. At Meerut the ground is against the engineer, so that the drains have to be swept down and nuisances exist. Lahore was the least healthy station he had occupied. P. 77, Q. 911, 912.

Captain J. E. T. NICOLLS—, states that stations in the plains of Northern India are uniformly flat, with slight undulations. Dinapore is surrounded with water during the rains, and Futtypore has a few marshes about it. Irrigation is used, sufficient for the crops only, from wells, and the water dries up quickly. There is every facility for surface drainage, but none for sewerage, there not being fall enough. Ordure, &c. is daily removed by hand and buried, and the latrines are arranged accordingly, and all nuisance avoided. Cesspits are not used, except at one time at Dinapore, and from which some of the wells became polluted. New sites are reported on by a committee of military, medical, and civil officers to the Commander-in-Chief, and are approved as a rule by the Governor General. This practice has obtained two or three years only ; formerly mere temporary stations probably grew into permanent ones without inquiry, and this may apply to the bulk of those existing. None of these plain stations are in the neighbourhood of hills which could be occupied instead. A new station is regularly laid out, so as to secure ample ventilation. Pp. 81, 82, Q. 1024–1080, and 1104, 1105.

Dr. MCLENNAN—, describes the climate of Poona and Mulligaum as tolerably healthy. Bombay is unhealthy ; the average temperature about 80°, and the yearly rain-fall 70 or 80 inches. The town is entirely without drainage, and there is a ditch round Fort George. Nuisances abound by improper disposal of the dead, cess-pools, foul dung heaps, and salt marshes on the neighbouring island of Salsette. There is occasional flooding which is probably beneficial. The surface filth is most disgusting especially on the beach, and this is aggravated by the daily washing over of the tide. Pp. 85, 86, Q. 1158–1165. Does not think any improvement could be made in the existing regulations for selection of sites. P. 88, Q. 1220.

Dr. COLVIN SMITH—, considers that St. Thomas' Mount, Madras, would be a healthy station under proper conditions. Rangoon was unhealthy during the war. Secunderabad was healthy when he was there. Kurnool is hot and unhealthy for Europeans, and Jubblepore is very malarious ; there is an immense marsh close to which the barracks are built, causing much sickness ; the neighbouring country being healthy, it might be easily drained. Rangoon was also marshy, and Prome too, which was abandoned from its unhealthiness. Impurities are removed daily at all stations under the police. Pp. 98, 99, Q.1352–1385. Much better sites were to be found in the immediate neigh-

[N.B.—See note p. 201 *ante*.]

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bourhood of those at present occupied at many stations. P. 102, Q. 1500, 1501.

Major-General GOODWYN—, describes Kurnal as flat, the canal being close to the cantonments, with no other facilities for drainage. Neemuch was well adapted for drainage in an undulating country, and the station high and dry. The Cawnpore barracks are on the lowest ground incapable of drainage. The drainage from the bazaar in the rear passes through the barrack lines. Cawnpore might be well drained; there are numerous excavations, receptacles for stagnant water and filth. At Calcutta it was difficult to drain Fort William properly. Berhampore was in a low marshy position. The selection of sites rested with the civil authorities. There is no flushing of drains and no outfalls are provided; it takes its natural course a short distance from the buildings. Pp. 106–108, Q. 1636–1700.

Major-General F. C. COTTON—, has inspected all the stations in Madras. Jackatalla is in a fine open country well supplied with water, and in a good position. P. 124, Q. 2008–2016. Irrigation, by which the country is kept flooded the greater part of the year and dry the rest, is carried out largely in Southern India without any ill effects. Excessive and continued heat, like cold, seems to make countries more safe from malaria and fever. Hong Kong, which is very dangerous, is temperate compared with Madras. P. 126, Q. 2038–2054. Had 20,000 natives and 40 Europeans employed on irrigation works at Godavery; the exposure did little or no harm to the temperate. Men are better employed in the air than confined in buildings. Q. 2083. Bangalore is a good healthy station. These high stations have great facilities for drainage and removal of impurities. Does not think Dr. Heyne's opinion now prevails that the laterite formation is usually associated with fever; he must have written 30 years ago. A careful investigation into the sources of fever would be highly valuable. It prevails at all levels up to 4,000 feet. Cholera cannot be connected with particular sites. P. 128, Q. 2092–2111.

Mr. LONGMORE—, describes the stations in Lower Bengal as situated on low ground having no elevation near. Calcutta is unhealthy from its flatness and imperfect drainage. The ventilation is obstructed within the fortifications, near which the river is also densely crowded with shipping, and from the habits of the natives, the chief part of the city inhabited by them is extremely pestilential. Improvements were in progress for flushing drains and getting rid of ordure thrown into the river, but Fort William will be always unhealthy for troops. Dead bodies often get entangled among the crowded shipping. They are thrown in the river, the people being too poor to purchase fuel to burn them, for which Government should provide wood. Barrackpore is very superior in all sanitary respects to Calcutta. Pp. 129, 130, Q. 2130–2157. Dinapore has always been unhealthy; there is a nullah which receives all kinds of filth, and into which the river Soane periodically overflows; it is a bad station. P. 132, Q. 2181.

Dr. MACLEAN—, considers that many of the stations of Madras were occupied without regard to sanitary considerations, then never thought of, but merely by accident because the troops happened first to encamp there. Attention is now paid to the selection of proper sites, but the rule is sometimes forgotten. Mentions an instance when he was placed on a committee and asked to sign a report in favour of a site without having been summoned. It turned out bad and was condemned. Pp. 136, 137, Q. 2223–2238. Pondicherry is not crowded, and is better

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drained than Madras, and the water better; it is consequently more healthy. The soil in the Nizam's country is granite, and where granite is in a state of decay places are unhealthy; also when the ground is broken up for the first time. The application of water is beneficial. P. 139, Q. 2306–2320. Sir Patrick Grant has urged the abandonment of the cantonment at Secunderabad. Q. 2343.

Dr. McCOSH—, describes Prome as particularly unhealthy; it is shut out from the prevailing winds, and inundated during the rains; selected without reference to sanitary considerations, being an important town of Burmah. There is a range of hills about 50 miles distant. The Irrawaddy is navigable at all seasons to and above Prome. Rangoon is liable to tidal inundation, but is a healthy station for the tropics, much better than Calcutta; so is Pegu generally as compared with Bengal. There are no hills within 100 miles of Rangoon. The whole country is annually flooded, and when the river falls stagnant pools are left to evaporate between the nullahs; drainage to carry off the water rapidly might be easily effected. Pp. 146, 147, Q. 2444–2488.

Sir JOHN LAWRENCE—, considers that some sites for cantonments have been extremely well selected, others badly. Drainage has not been cared for as it ought, but this has improved considerably of late, and much attention has been paid to latrines, &c. P. 190, Q. 2922–2924. Improvements might be made in the cities, as Delhi and Lahore; but epidemics often appear in the cantonments some miles off, before the towns. The whole country round these old cities is rotten and decayed, so that it is difficult to find healthy sites within several miles. Great care is necessary in the selection; objections are not always obvious at first sight. The favourable character or otherwise much depends on the committee selected to report. The members should be specially qualified and appointed by the Governor-General and Commander-in-Chief, upon the recommendation of the Principal Medical Inspector, the General of Division, and the Governor of the Province. The best men should be brought from any distance, if necessary; not choosing persons because they happen to be on the spot. Everything should be done to secure the best sites, and those which are proved unhealthy should be abandoned. Many of the present cantonments have arisen out of old standing camps. Trees for shade, &c. are advantages; it is underwood* that is unhealthy. P. 197, Q. 3017–3032.

Col. GREATHED—, states that there are establishments for surface cleansing and removal of refuse under the brigadier at all stations; there are under him the Engineer, Bazaar Superintendent, and Quartermaster of the week, who makes his report. The refuse is often burned; and there is no annoyance from the bazaars, latrines, stables, or slaughter-houses; only from the barrack urinaries. There are very good regulations. P. 202, Q. 3120–3132.

Dr. BIRD—, describes Bombay and Colaba as undrained, warm, damp, and unhealthy during eight months in the year; Poona and Kirkee are comparatively dry and temperate; Poona is one of the

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* The Poona Committee recommend that no hedge-rows in the neighbourhood of cantonments and military roads be allowed to exceed three feet in height. (Appendix, p. 735.) The Muttra Committee point out the obnoxious practice of brick-burning near the works at new stations; stable litter, bones, and ordure are the ordinary fuel, creating wide spread abomination. At Peshawur, such kilns were burning 7½ years, and the health of the troops considerably improved after these were allowed to burn out in 1857. (Appendix, p. 213.)

[N.B.—See notes pp. 201 and 202 *ante.*]

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healthiest localities in India. Belgaum is less favourable, there are ravines and broken ground about the cantonments. Pp. 213, 214, Q. 3413–3434. Kayra, which was abandoned, is an instance of a bad selection of site in the midst of swamps and broken ravines; the mortality was very great, though the buildings were altogether superior. P. 216, Q. 3482–3484.

Sir P. CAUTLEY—, states that the drainage of the stations in Bengal was generally defective, but latterly great alterations were being made. At Cawnpore the work has been done in detached bits without a comprehensive plan; had it been otherwise, it would doubtless have been effectual. The natives build their huts with mud dug at the spot, leaving the holes open ; so that in constructing the canal through the Cawn-bazaar ponds full of black filth were found ; there is also a total absence of ventilation ; thinks that if such places as Cawnpore, Delhi, and Kurnal were systematically drained there would be comparatively little disease. The foul ravines, want of drainage, and the filth in the bazaar, would account for the frightful mortality existing at Cawnpore. These things might be remedied at a moderate cost, by which the health both of Europeans and natives would be considerably improved. Mentions Shamli in the Doab as an instance of what might be done. This was a large town, always inundated in the wet season, and very unhealthy, the only channel for the water being a small tortuous nullah. A straight ditch was cut into the river, and there has never been a collection of water since. Colonel Baird Smith recommended a similar process at Meerut; and Major Wilberforce Greathed succeeded in draining the interior of Delhi by under drains into the Jumna. This want of drainage is the universal want from Calcutta upwards; open drains cheaply constructed are the best for the purpose. P. 234, Q. 3901–3940. The unhealthiness of the cantonment at Delhi probably arose from its proximity to a nullah from an extensive jheel; had the natives been listened to in reference to this, to them notorious, jheel, the cantonment would not have been placed there. Delhi itself is one of the healthiest places in Bengal. Irrigation is not injurious, except when abused by overflooding and letting the water lie about in holes, which produces malaria, causing intermittent fever, and spleen ; this might be remedied by drainage combined with the irrigation and levelling the ground in the neighbourhood of towns. Pp. 236, 237, Q. 3960–3992.

Mr. A. GRANT—, states that the conservancy and sanitary arrangements of the hill stations are often extremely defective, though formerly they were much worse. Believes the prevalence of diarrhœa is to be attributed to these causes rather than to cold or damp. P. 262, Q. 4484–4492.

Dr. R. D. THOMPSON—, considers the mode of disposing of the sewage at Bombay very objectionable, it passes into the sea, and is very offensive ; the burial grounds are also very bad. P. 276, Q. 4873–4875.

Colonel DURAND—, thinks the question of stations of great importance ; no doubt sanitary improvement may always be going on, and the mortality might be reduced ; it is a question of expense. Stations have been moved with the extension of the frontier, but everything was done in Northern India by the aid of committees, &c. to select the best sites available. P. 287, Q. 5163–5172.

Sir C. TREVELYAN—, states that great care is now taken in the selection of sites ; nothing could be better than the site in the Neilgherries, where the climate is like the South of France. P. 292, Q. 5259–5261.

[N.B.—See note p. 201 *ante.*]

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Madras being flat is not well drained, but the river contains excellent fish; it is dammed up, and periodically scoured by the rains. Formerly the sewers discharged their contents over the dry banks, but gutters having been cut in the sand they now are emptied in deep water until carried out to sea by the floods. P. 293, Q. 5277–5284. Madras is, perhaps, the second city in the Queen's dominions, and probably contains a million inhabitants, but there is no census, which it is desirable should be taken. The drainage is very bad, there being no means of flushing the sewers from want of water. He had initiated a plan for a municipal council, who should be empowered to raise funds and to carry out improvements of this nature, which he hoped would be established. Attention to these matters is the more important, inasmuch as the health of the troops must be affected by the local conditions and health of the population by whom they are surrounded. P. 294, Q. 5289–5314.

Dr. HUGH FALCONER—, states that the mean level of the country about Calcutta is hardly above the highest tides, so that any kind of drainage is exceedingly difficult; the practice is to dig large tanks to catch the water; and the sites for buildings are raised with the soil dug out for the tanks. P. 305, Q. 5390–5398. The conditions of drainage and surface differ materially, according to position and elevation, which greatly affects health, the deltas of large rivers being always the most unhealthy. The organic matter which is washed down from the higher levels there undergoes decay. Next to temperature, moisture most affects the health of Europeans in India; the drier the climate, concurrently with diminution of temperature, the more healthy. The southern side of the Himalaya mountains is often deluged with rain (in some places it has been estimated as high as 500 inches during the year), whilst the northern side is perfectly dry and sterile. The Terrai, covered with forest, swamps, and jungle, is most deadly during the rains, from vegetable decomposition poisoning the air, affecting not man only, but often domestic animals. That part between the Indus and the Sutlej, which is now cultivated, drained, and dry, is healthy. P. 306, Q. 5405–5458. Is not aware that rocks in the abstract have anything to do with sanitary conditions. It is where these are ground down into mud, forming soil, that the difference of condition comes into play. Had been led, from observation at Burmah and Singapore, rather to regard ferruginous soils as salubrious. Considers excess of heat and excess of moisture among the irremovable causes of disease in India. P. 309, Q. 5469–5479.

Dr. SUTHERLAND—, observes that, according to the returns, the records of meteorological facts are very imperfect, so that the elements of local climate are often little known. Except the surface cleansing of cantonments, little attention has been paid to sanitary improvement, there being no proper drainage, and even the surface drainage is bad. The privies and urinals are offensive, which always indicates danger. The removal of excreta should take place at least twice a day, but the system admits of great improvement. Roof-guttering is generally deficient, and the cook-houses and ablution-rooms are drained into cesspits, by which means the subsoil is kept damp. The bazaars, often close to the cantonments, as at Bangalore, are filthy, undrained, except at the surface, and supplied with tank-water full of impurities; the houses overcrowded and ill-ventilated. The towns are under even worse conditions, containing all the elements which even in more temperate climates would predispose every kind of fatal epidemic. P.

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311, Q. 5490. No native population should be allowed within a certain distance from a military station; they should be to leeward, and plans should be laid down for streets, drainage, &c. before a bazaar is allowed to grow up. A porous soil, if undrained, speedily becomes saturated with decaying organic matter. By avoiding every removable cause of malaria, persons will be better able to withstand such as may be irremovable. P. 315. Q. 5510–5519.

Dr. WALLICH—, considers that sites should be selected on high grounds where there are trees which, without underwood, are beneficial. Stations are generally chosen from a military view, and the medical officer is little consulted; sanitary considerations not having been much thought of. P. 337, Q. 5889–5894.

Dr DEMPSTER—, considers that sanitary arrrangements must still be of first importance in the plains, where the great majority of deaths arise from diseases of undoubted malarious origin. Thinks that in the immediate neighbourhood of the notoriously unhealthy stations of Cawnpore, Kurnal, Dinapore, Delhi, Ghazeepore, &c., healthy localities exist; refers to evidence procured by the Canal Sanitary Committee on this point. P. 463. At Peshawur he was one of the committee for selecting the site for a new cantonment, who had presented a note on the necessity of prohibiting irrigation within one mile at least of the site, two miles being a more prudent distance in such a stiff, clayey soil, which should be thoroughly drained, of which the natural fall of the country admits. Has never since visited the place, therefore cannot say if the recommendations, with respect to irrigation, &c., were attended to, but believes that barracks have been erected on the original site, probably for military reasons. The prevailing diseases are colds, bowel complaints, and intermittent fevers in July, August, and September; but the mortality is unusually small. Much rain or westerly winds during these hot months produce unhealthiness. All the ordinary fruits and the water are wholesome, though the native population are prejudiced against water drinking. About eight miles to the east of Peshawur there is a fine open dry plain, and the soil is light and permeable, with large admixture of sand (about Kassim and Jubba), affording an eligible site for location of Europeans. P. 470. Loodiana is now abandoned as a station. It was remarkably healthy at the commencement of his residence there, and very much the reverse afterwards, which was accounted for by a stoppage of the natural drainage of the place, and its consequent inundation during following very wet seasons, producing malaria and virulent fever, from which the troops almost universally suffered, and it happened that those who occupied the best barracks from being nearer the malarious influence suffered more than others worst accommodated at a greater distance. The officers were nearest of all, and were affected longest. P. 471. Meerut (from 1850 to 1854) has long proved one of the most healthy stations, at which sick from Loodiana and Lahore quickly regained strength. No river or low moist land in the vicinity. An open plain 30 miles from the Ganges. Loose permeable soil of humus clay and sand. Good water from 11 to 24 feet of surface in dry season. Copious periodical rains. European fruits and vegetables abound. The general drainage is good; some defective portions were being regularly drained in 1854. The drains, however, were open (the expense of covering being thought too great), and highly offensive in hot weather, though lime was used every 24 hours. Recommends the practice of digging trenches behind the camp for native resort, to be periodically filled up. P. 472.

[N.B.—See note p. 201 *ante*].

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Cawnpore is notorious as one of the most unhealthy stations, nearly seven miles along the edge of a high bank, overlooking a very wide portion of the Ganges, nine-tenths of the channel being dry, except during the rains ; the bank is chiefly clay, and is traversed by deep ravines. When the mutiny broke out large new barracks were being erected on a site which had been selected in the dry season, without inquiry, and which he found after the rains in 1856 to be a concealed marsh, covered with rank grass, and ankle-deep with water. Men placed on a similar site were more unhealthy than others occupying bad barracks close to the filthy city. The heat, soil, difficulty of drainage, and proximity of the Ganges combined to render Cawnpore unfit for location of Europeans. P. 473. Lucknow has several square miles of land immediately to the north well suited for barracks ; it was found dry and free from swamp during the wet season. Natural drainage good ; at a safe distance from the Goomtee and from the city. Found from inquiries that the inhabitants of this district were generally healthy ; being within two hours of Cawnpore by rail, it may be found desirable to remove the force now kept there to Lucknow. P. 473. At Delhi the troops had been removed from the city, where they were healthy, to cantonments on the edge of low irrigated land, which proved so pestilential that the ground was abandoned. On inquiry he found that 90 per cent. of the natives in that locality were afflicted with spleen disease. His observations were afterwards confirmed by Dr. Paton. Believes that a comparatively safe position may be found some miles south of Delhi. P. 474. Dinapore is situated on the Ganges, much like Cawnpore. The soil, a rich mould, subject to constant overflow during the rains ; irremediably vicious as a European station. Fever and dysentery are generally prevalent in autumn, and cholera nearly every year. The climate here is neither so hot nor so cold as in the upper provinces. P. 474. Almorah, the capital of the hill district of Kumaon, is about 40 miles in the interior from the foot of the hills, stands 4,500 feet above the sea. Seasons similar to Landour ; climate generally agreeable ; slight diarrhœa prevalent on first residence (attributed to the water), also intermittent fever. Goitre is endemic in the neighbouring valleys. P. 475. Simla is also 40 miles in the interior of the hills ; elevation, soil, and climate similar to Landour, heavily timbered, much grass and underwood. On some occasions low typhoid fever has prevailed. P. 475. Darjeeling, in the Sikkim territory, nearly as cool, but more moist than Landour. The barracks generally superior, but destitute of wash-houses. Air so moist that cold is seldom taken by remaining in damp clothes. Croup prevails among the young. Jungle should be passed when the sun is well up, and during hot or cold seasons. P. 475. Cantonments should be dry and in a well-drained country, free from liability to inundation, on light permeable soil. Avoid river-banks or marshes. The health of the natives should be inquired into, and the quality and supply of the water. P. 475.

II.—BARRACK AND HOSPITAL ACCOMMODATION.

BARRACKS AND HOSPITALS.

Sir RANALD MARTIN—, states that the structural arrangements of barracks and hospitals generally are very deficient, and there is great neglect in reference to the removal of nuisances. The buildings are of brick, but universally defective, narrow, low, and confined, except the new barracks, and even these have not sufficient cubic space. None of

[N.B.—See note p. 201 *ante*].

BARRACKS AND HOSPITALS.

the buildings are raised upon arches, nor have they double roofs, and the floors are continually damp. The health of the troops is very largely affected by bad barracks, as compared with those better constructed, as shown between Queen's and Company's barracks at Secunderabad. Verandahs are common, which are sometimes used for sleeping when the buildings are overcrowded. There is no rule as to cubic space, or ventilation, but punkahs and tatties are often beneficially used. The rooms are offensive at night. There is no organized system for providing means of ablution; water carriers are usually employed. Surface drainage and cleansing is quite as deficient as other arrangements, and should be placed under systematic medical police. Pp. 1, 2, Q. 10–54. The hospitals in India are not sufficiently ventilated, but they are attended by a class of warrant officers, besides orderlies and native attendants, so that as regards personal care they are not surpassed in the world. The buildings, drainage, &c. are defective, as in the barracks. P. 7, Q. 165–178.*

Colonel SWATMAN—, thought many of the old barracks most inferior; but the new ones admirable, with considerable means of ventilation. Lime washing and cleansing is now frequent. There is no difficulty as to the execution of repairs. The superintending engineer has large powers of action in emergency. P. 41, Q. 291–302. Baths were always provided at all places he had seen. P. 311.

Mr. A. STEWART—, states that the dragoon barracks at Cawnpore, which were very inferior, were removed before the mutiny. They were built in parallel lines from north to south, a bad arrangement, as the wind generally sets in from the east or west. No barracks ought to exist in the north-west provinces without being so placed as to get the full advantage of the wind. All the barracks are of one story, raised a little above the ground, but with no circulation of air underneath. It would be very advantageous to have the buildings well off the ground, so that the spaces underneath might be used as places of shelter and recreation; but if such places be not clean, ventilated, and drained, they are mischievous, especially as at Kirkee, where a drain with openings receiving water and filth ran underneath the barracks. The barracks were usually overcrowded. Difficult to state the cubical space per man; it should be double what it now is. Sir C. Napier allowed 1,000 feet per bed. Has never ascertained by measurement what the space has been. In some places the barrack roofs and walls are double, in others not. All the old barracks were bad. The new building at Meanmeer, built by Sir C. Napier, was the only good barrack he ever saw. It would be sound economy to provide such all over India. The ventilation at present is by doors and windows, which are not glazed, and the space for beds between these is so

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* See paper addressed to the East India Directors by Sir R. Martin, containing suggestions for promoting the health of the troops in India, pointing out that in 30 years from 1815 to 1845 ten millions sterling had been wasted by preventible mortality among the troops, and recommending various specified improvements in the structure, drainage, and ventilation of barracks and hospitals; also a better selection of stations on the hills; with hints for properly investigating the mountain climates. Addendum (No. 2), p. 19. The Umritsir Committee suggest the use of hollow bricks for barracks, which would not retain the heat so long after sunset (Appendix, p. 190.) The Poona Committee advise that barracks be lime washed "regimentally," and brushes kept in store for this purpose (Appendix, p. 735.) The Dinapore Committee consider that tatties are apt to cause chills and bring on rheumatism or ague. (Appendix, p. 59.)

[N.B. See notes pp. 201 and 202 *ante*].

Barracks and Hospitals.

narrow that the men lie exposed to thorough draughts; the men, therefore, both in barracks and hospital, suffer as much from injudicious ventilation as from want of ventilation. Sometimes the men sleep in the verandahs for want of space inside. These draughts are especially injurious to patients suffering from chronic dysentery in the cold months. Tatties are used to cool the air during the hot months. At Meerut the barracks are arranged like those at Cawnpore; they were frequently complained of from 1851 to 1855; some improvements have been made. The barracks at Meerut were very bad and deficient; there was no accommodation for the married soldiers, who were therefore put into the enclosed verandahs. By great good fortune there was no epidemic when he was there. Considers the practice which prevails in India of placing the saddlery in the same room in which the men sleep very objectionable, impeding ventilation, &c. In new barracks room might be provided for the saddlery at the end of the dormitories. The infantry at Meerut are quartered in detached masonry huts, with about 30 men each; these are favourable to ventilation if well carried out. The hospital at Meerut was very badly lighted, so dark that operations could only be performed after carrying the patients into the verandah, where they would be exposed to dust, sun, and wind. The hospitals generally are worse than the barracks. The thatched roofs are cooler than tiles, but liable to fire; never tried the difference with a thermometer; they are generally single. The old Lahore barracks were bad and very unhealthy; the new buildings are very fine. Umballa has the best barrack after the new one at Meanmeer. The infantry barrack not so good; it is a good barrack on a bad site. Hears that the health of the place has latterly been much improved by sanitary arrangements. Served at Kirkee 4½ years. The barracks are old and bad, only eight inches above the ground. The natural drainage of the site is favourable. Soil partly black. Kirkee is 1,855 feet above the sea. Throughout India there is great want of proper means of ablution; men usually wash in the verandah or do the best they can; they can very rarely bathe; such accommodation ought always to be provided. There is no difficulty in obtaining water by means of carriers, either with bullocks or hand labour. Pp. 53–60, Q. 654–768. In Bombay the married soldier is usually better provided for than in Bengal, where there is often no separate accommodation; at Kirkee they were in detached huts. A matron is provided in the Bombay hospitals to attend the women, but not in Bengal. P. 62, Q. 797–801.

Lieutenant-Colonel Gall—, states that the barracks at Kirkee are about 30 years old; small, without ventilation; having no protection from the monsoon. Wind and rain beat in during the wet season. It is very oppressive during the hot season. Barracks should be lofty and ventilated in a proper manner, not from the doors and windows. More space should be allowed for the beds. There should be double roofs and broad verandahs, in which the men could amuse themselves without exposure to the sun. At Lahore the new barracks were not built when he was there; troops were much huddled together in the previous temporary ones. Washing-houses were introduced at Meerut in 1853. Recommends large and deep swimming baths, for which there is abundance of water. The men bathe in the river at Kirkee. For linen there is a washerman in every troop, who engages his own servants, and is responsible. The orderly officer reports as to the general cleanliness of the barracks to the commanding officer, besides which there is a barrack committee. Any works requiring expense would be reported

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to the brigadier, who cannot go beyond a small amount, even on emergency ; if expensive the engineer must report to his superior, and it might be further referred. There are printed "Station Orders" furnished to the officers. Pp. 76, 77, Q. 904–924. The bazaars are under bazaar masters, who are magistrates. Much liquor is clandestinely sold in the bazaars. It is the master's duty to prevent this among the soldiers, and any delinquents are severely punished. Camp followers are quartered at a little distance outside the lines, under the supervision of the commander. The quartermaster superintends the removal of surface nuisances, extending to the camp followers, and he is responsible to the commanding officer. Disorderly women may be turned out of the bazaar or sent before the magistrate. Knows of no observation with a view to prevention of venereal disease. The bazaar master is always a European. The bazaars are usually in pretty good order, and contrast favourably with native towns. There is difficulty in overcoming offensive habits of the natives. Pp. 76–78, Q. 904–942. Large roomy barracks should always be provided, 10 feet at least being allowed for two beds, and the rooms 25 feet high. It would be economical in the end. The same rule as to space should apply to hospitals in a stronger degree. Pp. 80, 81, Q. 1013–1018.

Capt. J. E. T. **NICOLLS**—, states that the buildings are all of one story ; the floors raised a foot or so from the ground by brick rubbish ; the ordinary materials are used ; they have single roofs; thinks improvements in details may be made, but approves generally the standard plans now issued by the Government. The regulation is to have plunge baths. P. 83, Q. 1081-1098.

Dr. **MCLELLAN**—, describes the barracks in Bombay as usually built of brick, with tile roofs single ; temporary buildings are of wood, with thatched or cadgan roofs. Floors are generally raised from one to four feet solid ; but it would be better if they were on arches high enough to be used as places of amusement or work ; 1,200 cubic feet per man was the regulated amount. The verandahs are from 7 to 12 feet wide. There are ventilators in the roof, but the air is close at night. Soldiers will shut themselves up. On the whole, considers the barrack accommodation deficient. Better means for ablution should be provided, and baths should not be made dark and uninviting as at Poona. Pp. 86, 87, Q. 1169–1195 ; p. 92, Q. 1282. 1,800 cubic feet space is allowed in hospitals. Q. 1283.

Capt. W. S. **MOORSOM**—, explained an improved punkah, for providing an increased current of air throughout the width of a large room, consisting of fans of wetted canvass, propelled by bullock power and multiplying wheels. The temperature would be regulated at pleasure by the velocity and quantity of water used. One machine driving 10 punkahs by a single bullock will suffice for a building containing 100 men, but by increased power barracks for 1,000 or 10,000 might be thus ventilated by one machine. Estimated cost of machine for 100 men 68*l*., for 1,000 about six times as much. Pp. 95–98, Q. 1314–1348.

Dr. **COLVIN SMITH**—, states that the old barracks at Secunderabad were badly built, on low, undrained ground, full of holes. The barracks at St. Thomas Mount are badly situated under a hill, where there was no breeze, very close and confined. The new barracks at Trimulgherry are the finest he has ever seen. P. 100, Q. 1392-1397. Ventilation is usually from the top; thinks that tatties should be used to reduce the temperature; neither punkahs or thermantidotes were used in the

[N.B.—See note p. 201 *ante*].

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barracks. There are ample means of ablution (but not baths) provided, of which the men do not sufficiently avail themselves. The arrangements in the hospitals are not convenient for ablution of the sick. P. 100, Q. 1406–1431. Thinks the native hospitals very good, but the old European ones deficient, badly ventilated, and air at night very impure from overcrowding; punkahs are used, and sometimes tatties; they should be always.

Major-General GOODWYN—, describes the old barracks at Cawnpore and Calcutta as very bad; they were, consequently, pulled down. At Chinsurah they were pretty good, but not sufficiently raised; the urinaries and cook rooms badly placed. P. 107, Q. 1654, 1663, 1674. Refuse and impurities are daily removed by hand labour; condemns the system of urine tubs in barracks P. 108, Q. 1681–1696. Baths are not always provided. There was only one at Fort William. There were none on the plan of the new barracks in course of erection, 1857. Barracks are one or two stories high, sometimes three. Brick is the principal material; the floors are generally limed; had recommended the use of iron in lieu of the unseasoned wood which alone can be got in India, and asphalte for floors, which had been tried at Fort William with perfect success. The increased durability would balance the original increase of cost in 20 years, as no wood there lasts more than eight years, rendering constant repairs, and new roofs necessary. The light iron work also offers great facilities for ventilation. The bricks should be of better quality, to keep out moisture; these iron roofs were double; he recommended double iron doors also, so as to dispense with both timber and grass, both of which are so liable to take fire. The absence of raised arcaded basements is a great fault. Thinks thermantidotes should be used; punkahs not sufficient. A new one was being tried, which he had not seen, it might have been Capt. Moorsom's. Thinks the cubical space allowed has been 800 or 1,000 feet. Slight repairs are done on the request of the commanding officer; but estimates are sent to Government for periodical repairs. They are usually proceeded with at once. P. 108, Q. 1710–1788.

Major-General COTTON—, thinks the new barracks at Jackatalla are unnecessarily high, as it increases the cost, and ventilation could be contrived without. P. 125, Q. 2025–2029.

Mr. LONGMORE—, states that the barracks in Calcutta are raised on arched basements, which somewhat diminishes the want of free ventilation in the fort.* P. 131, Q. 2158–2162. The barracks at Dinapore are bad; not raised as they should be off the ground. New temporary barracks have recently been erected; they are, consequently, also on the ground, in parallel lines, and constructed of bad materials; intended to last five years, but will probably be patched up, and used for a much longer period. A large part of the mortality is owing to such defects in barracks. P. 132, Q. 2181–2208. Thinks the plan of daily removing excreta the best for such a locality as Lower Bengal. Q. 2217–2221.

Dr. MACLEAN—, describes the old barracks at Secunderabad as very faulty and overcrowded; 1,200 men being stowed away in buildings constructed for 700. The new Trimulgherry barracks have not yet been fairly tried, having so many quartered in them that the verandahs were filled with beds. P. 140, Q. 2339-2346. Overcrowding and bad ventilation were the master sins of the old system. Q. 2352. At

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* See description of new barracks at Fort William, Addendum No. 2, p. 136.

[N.B.—See note p. 201 *ante*].

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Secunderabad there were patcheries for married men, who were more healthy than men in barracks ; thinks the system of building costly barracks an unfortunate one ; the expense is so great that the requisite space is grudged, whilst the men would be much better in small detached bungalows, at much less cost. Epidemics also run through barracks ; isolated dwellings are far superior. Single story buildings, placed *en échelon*, containing half a company each, would be much better than larger barracks. P. 142, Q. 2373–2388.

Dr. McCosh—, states that the troops in Burmah were quartered in temporary wooden barracks, which were tolerably healthy. P. 147, Q. 2464, 2465. Never saw any built of masonry in that country. Q. 2482, 2483. Suggests that barracks should be constructed of common earthen conical pots about nine inches long, pervious to air, with circular roofs,—as used in Syria,—at half the ordinary cost. No timber would be required, so that they would be fire proof and ant proof, and last a century or two. P. 152, Q. 2630–2634. Ventilation provided by the engineer is often stopped by the men, which is the chief difficulty. Over-crowding is not common, but sometimes exists under force of circumstances. P. 153, Q. 2643–2646.

Mr. Julius Jeffreys—, is of opinion that much unhealthiness is produced by the barracks being too near the ground. They should be elevated 15 or 20 feet. Suggests a plan for building light temporary barracks of great strength, formed of thin wood scantling placed edgeways, and thin sheet iron, which may be put up very rapidly. All the parts, though rough, and readily procurable on the spot, being fitted beforehand, and no scaffolding required. More protective from either cold or heat than brickwork, and proof against ordinary causes of fire. Pp. 165–169, Q. 2802–2830. Suggests, also, a method of cooling the air, and of ventilation, by making a series of wells under the floors of buildings, dug to within a foot of the water level, and guarded from the admission of any decaying substances. The original expense would not exceed one year's cost of tatties. External air also may be pumped into the wells by a simple means described. P. 177, 178, Q. 2853–2859.

Sir John Lawrence—, considers the modern barrack accommodation in Bengal is excellent, twice as good as formerly. Thinks there is no ground for complaint ; but that they are too large. It would be better to build rooms to contain half a company each, as the men would be more comfortable and less subject to annoyance. The barracks at Sealkote are unreasonably good and extravagant ; they are higher than necessary. Those at Hyderabad are also vere fine. In Upper India it is not necessary to raise them on arches, though requisite in damp localities. The lower rooms might be used as libraries, workshops, and dining rooms, and the upper to sleep in. Lath and plaster or pots of earth outside flat roofs would serve the purpose of double roofs. The officers build their own houses, which are often not so good as the barracks now provided for the men. It would not much increase the expense to have smaller buildings. It is better to have two stories because there is not so much ground occupied and to be defended in case of disturbance. The front of the infantry barracks at Lahore was not less than a mile long ; the canteen being at one end, which causes great fatigue to the men. The building should be concentrated as far as compatible with sanitary precautions, as at Rawul Pindi. A portion of each cantonment should be partly fortified; easily defensible in case of attack. Thatched roofs

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should be avoided. Pp. 189–191, Q. 2902–2936; p. 196, Q. 3010–3012. Approves the plan of having cottages for the married soldiers. There should be a separate hospital for women, with a European matron. P. 198, Q. 3037, 3041.

Colonel **GREATHED**—, states that the new barracks are very good, the old very bad. The improvement commenced about 15 years ago. At Poona, Kurrachee, and Hyderabad there are excellent barracks. Thinks building entirely with brick is a disadvantage; in hot weather the smell caused by the sulphurous fumes is like that of a brickfield, and the brick flooring in the verandahs is excessively hot. Plastering might remedy this, but the best flooring is rammed earth washed over with cow-dung; it keeps away vermin better than anything else, and is durable. At Deesa the barracks were bad, and those at Jullundur, though well planned, were of bad materials, and the floors were damp. There is plenty of air, the doors being always open, and box ventilators in the roof. The hospitals are universally spacious and airy. Urine tubs were not used in his regiment; but the urinaries outside, necessarily near the barracks, were very offensive at all times; a nuisance which could not be got rid of, though the engineers did everything they could. The drainage might be very much improved in this respect. The latrines were good, and well managed. The cleansing, whitewashing, and repairing of barracks is periodically done by the engineers; so that requisitions have seldom to be made. There is never any difficulty when demands are feasible. Plunge baths are generally provided, which are always full and used by many of the men. Thinks there should be bathing parades for all the men twice a week (*i. e.* two or three companies daily), by general order. The ablution rooms are generally imperfect, and in hospitals especially very defective; there should be a warm bath room attached to each hospital. P. 199–202, Q. 3085–3119. The greatest advantage attends placing the married men in separate huts; they will forego any comfort for privacy; when families are together the children and mothers squabble; when separate they can also rear poultry and so on. The best huts are at Hyderabad. In the Bengal hospitals separate wards for women, with European matrons, are much needed. P. 209, Q. 3315.

Dr. **BIRD**—, considers the barrack floors at Colaba, in 1841–4, were not sufficiently elevated; they should be on arches, water might be found within three feet of the surface, they are built of brick. At Kirkee, Poona, and Belgaum half burnt bricks and lime or mud and stone are used, and the buildings form three sides of a square; there were huts of stone or mud for the married men, which are quite as healthy and more convenient. All barracks should consist of two stories, using the basement for kitchens, &c., and ablution rooms, at present very insufficient, both in barracks and hospitals; roofs should be double. Considers mud floors, as used by the natives, objectionable under all circumstances; wood should be used, next to wood, brick. The ventilation and light are obtained from venetian openings in the roofs or doors and windows, which are better than artificial ventilation. The provision of warm baths would be one of the greatest means of preserving health. It would be a saving in the end were all low country barracks reconstructed on these principles. P. 214–217, Q. 2426–2511.

Brig.-Gen. **RUSSELL**—, states that the new barracks generally in Madras are admirable; the old ones were deficient. The sanitary regulations are amply sufficient if carried out. The barracks at

[N.B.—See note p. 201 *ante*].

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Moulmein, built in 1826, were of wood thatched with leaves; they were rather too full on landing, 1,000 strong, and there was great want of accommodation for married people. There was a plan for new brick barracks, but he considers wood both cooler and drier; those built in 1826 were standing in 1857. The roofs should be shingled to prevent fire, and to bear the monsoon hurricanes. The Fort George barracks were very bad in 1845–7. An open drain passed close by; being within the fort no breeze could reach them. At Secunderabad the barracks were built in squares, one within another, and there was no ventilation; but after raising one of the buildings, in 1848, and putting on a Bengal roof, with wire gauze ventilators, no serious case of dysentery occurred among the men quartered within the building, the air of which was quite sweet in the morning, whilst the others were very offensive; these barracks were in a hollow with a swamp on one side and an old graveyard on the other. At Trichinopoly the temporary thatched mud buildings were much cooler than the bomb-proofs, which the men could neither bear by day, or sleep in by night. Improvements were made at considerable expense. Never knew the Madras Government refuse a reasonable request for the benefit of the troops. The Rangoon barracks were of wood. In the permanent barracks the ventilation is often bad, and any apertures within reach are apt to be stopped by the men to avoid draughts. Cleansing and whitewashing is properly attended to, and the floors are swept four times a day. The external surface cleansing and drainage was also well performed. Ample provision is made, and requisitions are invariably attended to. Urine tubs were placed in the verandahs at night but removed before gun-fire. The married people were sometimes very badly accommodated. Prefers huts for them in all cases. Pp. 226–228, Q. 3689 and 3747. Plunge baths and ample means of ablution were being provided by the engineers some years ago, if not stopped for want of money. P. 231, Q. 3856. The artillery barracks at Secunderabad are on higher ground than the infantry, and were never fully occupied; though the buildings were not so well ventilated, there were better means of drainage, better external ventilation, and the water was derived from a different source. P. 233, Q. 3885, 3894.

Colonel G. CAMPBELL—, considers the barracks in Bengal built on Sir C. Napier's principle quite as good as those in England; others not so good. There is not sufficient upper ventilation in the old ones, which are very close at night. Urine tubs were placed outside the barrack room. The buildings are thoroughly cleansed once a year, and the walls once a week. There are delays and difficulties in getting repairs, from official routine. The surface drainage is well attended to. The mud floors are dry if sound, but when broken they retain and absorb the wet. There were baths of sufficient means of ablution in the new barracks, iron basins with plugs being used. In the old barracks there are earthern basins, which do not so well secure the use of fresh water by each man. Should think all had baths by this time. Always had a bathing tent on the march fitted up with large tubs. The cleansing of the bazaars is generally well attended to. The 52nd were in very bad temporary barracks at Lucknow, and believes those in which they are now, at Jhansi, are very unfit. At Lucknow they were put into the king's stables, and while there cholera broke out, but only in that building, under which manure was afterwards found several feet deep. This was an accident, *i.e.*, no one knew it, and though the air at night had been highly offensive the

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men had not complained. Pp. 239–244, Q. 4011–4053. The accommodation for married people is generally comfortable. Thinks separate houses to contain three families the best arrangement, as one servant might do for them. P. 246, Q. 4209–4210 and 4218.

Colonel **DURAND**—, thinks that the Governments of India of late years have none of them failed in doing everything that was possible to promote the comfort of the soldier, although the exigencies of the service has rendered the progress slow and difficult. Lord Ellenborough paid great attention to hospitals, as well as other arrangements. P. 283, Q. 5091–5095.

Sir C. **TREVELYAN**—, had much improved the barracks at Fort George, Madras, by lowering the wall of the Fort six feet,—the sea breeze being thus freely admitted throughout the Fort,—by opening doors, and enlarging windows. The beneficial effect was instantaneous. Verandahs were also erected for each story, and a large cistern, supplied by a steam pump, was erected to flush out the drains with sea water. The barracks in the Neilgherries are admirable; but those at Trichinopoly might be improved in many ways. A new wing was added to the hospital at Fort George, including rooms for officers; the drainage and ventilation of which had also been set right. Ground floors are coolest, and are therefore to be preferred, provided there be no malaria from the soil. P. 290, Q. 5238–5277.

Dr. **SUTHERLAND**—, considers that the barrack-rooms are too long, and contain too many men. Separate houses for 20 or 25 men should be the limit, placed *en échelon*. Double verandahs impede ventilation; and not more than two rows of beds should ever be placed between the opposite doors and windows. The men are often exposed to draughts, there being no sufficient ventilation at the top. The cubic space is often too small, and where it appears sufficient, from the great height, the superficial area is too confined. The buildings are not raised above the ground so as to secure perflation of air underneath. P. 311, Q. 5490–5493. The hospitals generally have similar defects to the barracks, and are not provided with means for bathing, which some of the barracks have. They are attended by natives; but there should be trained regimental orderlies. The native hospitals are the most defective in everything. P. 313, Q. 5495. The cubic space should be regulated according to position. For India, the minimum should be 1,000 cubic feet per man, with 80 square feet surface; the maximum 1,500 cubic feet, and 100 square feet area, or about double that allowed at home. Hospitals should have from 1,500 to 2,000 cubic feet per bed. P. 315, Q. 5508, 5509.

Sir A. **TULLOCH**—, considers the cubical space per man in barracks in India should not be less than 800 feet, and the roofs should be double. P. 317, Q. 5545–5548. Men would be more healthy and comfortable in small buildings for 10 men each, which the men might assist to erect themselves, than in enormous barracks erected at a cost of 80*l.* or 90*l.* per man. In the West Indies the 68th regiment built themselves huts, which lasted seven years, for 30*s.* a hut. In India the cost of barracks is 12*l.* per man annually. P. 325, Q. 5645–5650.

Dr. **MOUAT**—, states that the native troops usually hut themselves, being averse to barracks from caste prejudices and love of privacy Their families are not always with them. The huts are constructed of mud, with grass or palm leaf roof. They would not tolerate much

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interference. There is no drainage except ditches around the huts, and the lines are very dirty. Personally, the sepoys are clean, but otherwise dirty in their habits. P. 329, Q. 5674–5702. If the huts were properly ventilated and raised off the ground, and subsoil drainage enforced, their health and condition would be much improved. If done, when in course of erection, and the reason explained to them, there would be no objection to such interference. P. 331, Q. 5727–5733. There was one barrack at Dorundah, in which three native regiments were quartered in succession. There was no great objection raised, and fair average health was maintained by the men. P. 334, Q. 5801–5805.

Dr. WALLICH—, describes the huts of the native troops as huddled together and the drainage utterly disregarded. They are often surrounded by jungle impeding ventilation and are built of bamboo and straw with mud. The men sleep outside, except during the rains. It would be quite possible to induce them to live in barracks, which would be more healthy. P. 334, Q. 5812-5835.

Serjeant-Major WALKER—, would recommend more plunge baths at the stations. There is nothing the soldier in India likes so much. P. 343, Q. 6028–6029. Does not think more light is wanted in barrack rooms at night. One lamp in each room is sufficient for duty. P. 343, Q. 6038–6040. Barracks are often not sufficiently high and ventilated, and filthy cesspools emit fearful smells. The rooms at night are very bad. The closets are well kept, but are never more than 40 or 60 yards from the barracks. P. 346, Q. 6129-6132, 6137–6139. There are means of washing. The barracks, and the plains generally might be much more healthy if drained. Pools of water often lie about within the lines for days, and are dried by the sun, causing fever. Stone slabs would make the best floors. The cow dung smells, and is not liked from being dirty and long damp after being washed. P. 346, Q. 6146–6153.

Dr. DEMPSTER—, describes the barracks at Umballa, Meerut, and Loodiana as good, others are very bad; but has found that in unhealthy seasons troops in the worst of them suffered less than others in better buildings at the same stations, simply because the former had the advantage in certain local conditions. The married men object to have their families near the unmarried barrack rooms; therefore separate small buildings, at convenient distances, should be provided for the married men. These must be thatched; no small unthatched building is habitable by Europeans in the hot season. Personal ablution for the soldier has been altogether neglected, until of late years means have been provided at some of the stations. At Cawnpore, as late as 1856, he had himself caused such articles as soap, towels, and pans to be provided in an outbuilding. Bathing should be generally adopted; recommends pouring water over the body in preference to the plunge bath. The removal of surface nuisances has been attended to of late years, but the habits of the sepoy still present formidable difficulties. P. 464. The means of ventilation are by the punkahs ordinarily in use, pulled by natives. Also tatties, which will reduce the temperature from 105° to 76° almost instantaneously; and the thermandidote invented by Dr. Ranken. These, however, should be properly and carefully applied at the top of the rooms to avoid draughts, on the plan proposed by Capt. Moorsom for revolving barrack punkahs. P. 468.

[N.B.—See note p. 201 *ante*].

III.—IMPROVED TENTS.

TENTS.

Mr. A. STEWART—, suggests that hospital tents should be large and double-walled, with 2½ feet space between. Privy tents should be provided for troops on march, or in the field. P. 58, Q. 728.

Mr. JULIUS JEFFREYS—, considers that it would be highly advantageous to dispense with the very numerous tent walls in an encampment. Suggests a method of forming large tent rooms, large enough for a regiment, to be raised at one haul by bullocks, uniting comparatively great stability with most perfect ventilation, and water-tight. Suggests also that for protection from the sun the reflective power and opacity of metal should be employed by covering the canvass for these tents with bright tin bronze, by which means they would surpass many substantial buildings in their resistance of solar heat (proved by careful thermometrical experiments). Such tents would be cheaper than those now in use, of much less weight, occupy less space, and be greatly superior in all sanitary requirements. They may be put up as single tents, or any size required. The bronzed cloth might be made in India. Pp. 169–177, Q. 2831–2852.

Mr. HUGHES—, exhibited the model of a corrugated iron tent or portable building, with double roof and complete ventilation, capable of lodging 25 men, which may be erected by the men in two hours. Cool, fire-proof, strong, durable, and easily removed or repaired, every part being made in duplicate of uniform size. The weight of the tent is seven tons, and the cost under 200*l*. each. P. 288, Q. 5178–5237.

IV.—SUPPLY OF WATER.

WATER SUPPLY.

Sir R. MARTIN—, states that the water in India is usually supplied by tanks and from rivers, and conveyed by hand instead of pipes; the tanks are much neglected. P. 1, Q. 14–18.

Colonel SWATMAN—, described the water at Agra brackish. Water generally in India requires filtration, which is not attended to. The river water especially contains much sediment. P. 43, Q. 367–374.

Mr. A. STEWART—, states that much water is drank by the soldiers, which is usually good. It might be filtered with advantage, as is often but not generally done, and should be drawn from taps instead of being dipped out of the cask, which stirs up the sediment. P. 61, Q. 786–796.

Capt. J. E. T. NICOLLS—, states that all water for the troops in the plains of Upper India is taken from wells, varying from 20 to 70 feet deep; it is much the same throughout, and the best that can be obtained; it is always filtered. The carriage of water to the hill stations is expensive. Pp. 82, 83, Q. 1071, 1099, 1103. Has been told that in the Himalayas the spring water is apt to be contaminated by poisonous plants; it is there collected in tanks. P. 85, Q. 1151–1153.

Dr. McLELLAN—, states that the water at Bombay, brought from Vehar, is abundant and good; it is not yet laid on to the houses, but the tanks are regularly cleansed. P. 86, Q. 1166–1168.

Dr. COLVIN SMITH—, describes the water, which he examined both chemically and microscopically, at Secunderabad (native lines) as bad, producing guinea worm. The men who took water from the river at Kurnool seldom suffered from guinea worm. Pp. 99, 100, Q. 1386–1391. Generally the water is good, has known bad wells, but good water

[N.B.—See note p. 201 *ante*].

WATER SUPPLY.

could be procured at all the stations he had seen. The bad water might be purified by filtration. P. 103, Q. 1538–1542.

Major-General GOODWYN—, states that the Bengal stations are mostly supplied from wells by carriers; at Berhampore, it was from the river; there is no storing. P. 108, Q. 1702–1711.

Major-General COTTON—, had found bad water in one spot only in Southern India. P. 126, Q. 2063, 2064.

Mr. LONGMORE—, states that the well water within Fort William, Calcutta, is bad, and the barracks are therefore supplied from a tank at some distance by carriers, who require watching, to see that they really go there, instead of to the ditch reservoirs. The men drink a good deal of water. The tank is supplied by rain water and a certain amount of percolation from the impure river. There was no bath in the fort. P. 131, Q. 2163–2171.

Dr. McCOSH—, states that at Landour water is obliged to be brought from a descent of 1,000 to 1,500 feet; but water is always to be found from 1,000 to 1,200 feet below the summit of a ridge, which may be a better site for a station than the top. P. 150, Q. 2563–2566.

Dr. ANGUS SMITH—, considers it would be unsafe to take water from wells without chemical analysis, and that a professional chemist at each presidency in India for consultation in various subjects would probably be of great value. Bad water would cause dysentery or ague; it might be easily purified by filtration through charcoal and sand; alum is not desirable. Pp. 162–164, Q. 2742–2767.

Mr. JULIUS JEFFREYS—, believes the upper stations in Bengal were almost entirely supplied from wells, and in the lower country from tanks, the latter being often full of organic impurities. Considers that wooden reservoirs lined with thin sheet iron might readily be constructed by the men themselves; so that by the addition of a syphon and filter there might always be a store of pure water. At a very trifling cost the men might also acidulate the water and make it brisk with carbonic acid. P. 165, Q. 2794–2801.

Recommends the filtration of water after boiling, upon a simple plan, described by him. P. 494. He also submits a method of rendering vapid water grateful and refreshing by means of gas generated from acid and lime; also by charcoal and lime stone, where acid cannot be easily obtained. P. 494.

Sir JOHN LAWRENCE—, states that the natives look much to the quality of the water, and often judge better than the English. P. 197, Q. 3013–3016.

Colonel GREATHED—, describes the water at Poona as abundant and good. At Kurrachee and Hyderabad the water which percolates from the Indus is dirty, but good. It is commonly filtered through three jars of charcoal and sand. P. 202, Q. 3133–3135.

Dr. BIRD—, states that Colaba is supplied with rain water stored at Salsette. Poona and Kirkee have wells. Believes it produces guinea worm in the hot weather. It contains much organic matter, and the wells are rendered foul by constant splashing and dipping. Tanks should be above ground and discharge into open troughs. Filtration would prevent much disease. P. 214, Q. 3433–3440.

Colonel CAMPBELL—, states that the well water generally was good and abundant. It was rather scarce at Umballa, and bad at Lucknow, a number of elephants having been buried near the wells. P. 241, Q. 4059–4063. Had recommended that in the hills the rain water should be caught and stored in tanks to avoid the organic impurities

[N.B.—See note p. 201 *ante*].

with which it must become impregnated from surface nuisances about the stations, thus causing diarrhœa, &c. P. 244, Q. 4152–4156.

Dr. LETHEBY—, is of opinion that impure water is even a more powerful source of disease than impure air. In 1853–4 the mortality from cholera was at least 3½ times greater in parts of Southwark supplied with water impregnated with sewage than in other localities of the same district supplied with different water. Shallow wells will be charged with organic matter, especially in warm climates. Decomposing vegetable matter is more injurious than animal, but it rarely gives warning either by smell or taste. Water (like other fluids) comes in contact with those internal parts of the body which are affected by dysentery, cholera, diarrhœa, &c. Water may be easily tested for organic impurity by Condy's fluid (permanganate of potash), which destroys all organic matter; also by nitrate of silver, chloride of gold, evaporation, and ignition. The presence of living animals and vegetables in stagnant water, tanks, &c. is beneficial. Organic impurities are easily removed by filtration through a ball of manufactured charcoal with peroxide of iron, connected with a flexible syphon. These are very cheap, and may be easily used by an army on the march. All the water used at military stations should be so filtered; it might be afterwards stored and kept. The action of heat is temporary only. The quality of water is especially important in epidemic seasons. The utmost care should be taken in the selection and examination of the water. Water highly charged with organic matter (*e.g.* the well at Secunderabad, containing 11½ grains per gallon) is capable of producing much disease. Iron pipes should be used for distribution. For bad water a pinch of alum, or, better still, sulphuric acid, so as barely to acidulate it, would neutralize the morbification of organic matter. Pp. 265–269, Q. 4562–4689.

Dr. THOMPSON—, had examined the various wells of London, and found them much contaminated by sewage impurities, especially at the lower levels. Considers the water generally in the tanks and wells of India very much more impure. His experience of them has been quite shocking. The tanks are unprotected, and turbid from dust, &c.; persons bathe in them; surface impurities are washed into them. Had found great mortality, during cholera epidemics, to arise from the use of impure water in London (giving examples similar to those mentioned by Dr. Letheby). Would consider the water used in India highly dangerous in Marylebone, and would expect the mortality to be very much higher. Had no cholera on board his ship at Canton, having himself carefully selected the water. Cholera did exist in other ships. Connected occurrence of cholera at Bombay with impure tank water. The best process for determining the quantity of organic matter is to distil the ammonia. To purify the water it should be filtered and boiled. He divides water into three heads:—1. From pastoral drainage or natural springs, which is pure; 2. Agricultural drainage or rivers containing surface impurities; 3. Well drainage, with impurities in a greater degree. With regard to geological formation, the purest water is obtained from the Primary rocks, as granite and mica, and clay slate. Chalk is objectionable. Sand generally supplies pure water. Any organic matter in water is injurious; vegetable, is less dangerous than animal matter; five or six grains per gallon would be dangerous. Before giving an opinion on any water, a delicate analysis both as to quality and quantity of organic matter would be requisite. Rain water collected on flat roofs and stored in iron or slate tanks would undergo

WATER SUPPLY.

no change. All the elevated grounds would supply the best water. Determining the quality of the water and its proper purification are matters of paramount importance to the troops. Believes that from the absence of cool water the men are more inclined to intemperance. It has been proved that abstainers have an advantage of 19 per cent. over those who drink. The point of contact between pure water and organic matter, as in marshes, is most injurious; also where the organic matter of impure water comes in contact with the sea water. Pp. 270–276, Q. 4708–4796.

Dr. A. H. HASSALL—, considers that the wells in India would probably contain a quantity of organic matter by percolation. Water may be contaminated by cesspools at 100 yards or more. Water from mountain land and rain water would be tolerably pure. Wells should be covered and the water filtered; but filters require renewal, neither do they in many cases remove all impurity. Frequently water which is very palatable is impure. Diseases might be propagated by impure water, and it would be dangerous to place a regiment where another had been previously suffering from cholera with the same water supply. A practical chemist only can determine the amount of organic matter in water, though a tolerably exact opinion may be formed by any medical man, both by analysis and with the microscope. Pp. 276–278, Q. 4897–4950.

Sir C. TREVELYAN—, states that the water supply of Madras is very deficient, there being no means of flushing the drains. The water is chiefly derived from wells near the surface, which are partially contaminated by the drains. P. 294, Q. 5303–5318.

Dr. HUGH FALCONER—, does not consider stagnant water necessarily bad. If there be sufficient vegetable and animal life in the water, it will be maintained in a sound state. The water at Calcutta is generally good, *i.e.*, in the ponds, which are covered with vegetation, from which alone the natives will drink. These are quite free from the drainage of the country near them. P. 306, Q. 5399–5405. Would prefer water having a fair balance of vegetable and animal life in it to rain water, though the latter carefully stored would be good. The tanks from which the troops generally are supplied do not contain living animal or vegetable matter, and the water is, therefore, not so good. They are too deep. P. 309, Q. 5459–5468.

Dr. SUTHERLAND—, from an examination of returns from India, is of opinion that the state of the water supply, both for domestic use and for drainage, is one of the cardinal defects in India, and a predisposing cause of diseases, especially of the zymotic class. P. 311, Q. 5490, 5521–5525.

Dr. MOUAT—, states that the native lines are usually supplied from tanks of rain and drainage water, and springs, one of which is set apart for bathing, and generally one large drinking tank is kept purer than the rest; they are often muddy after rain. In Calcutta, they are filled from the river. The natives attach importance to pure water, and ascribe diseases to bad water. Cholera would be produced in marshy districts and by water from tidal rivers. The men would not permanently object to iron pipes for conveying water, if proper management be observed in their introduction. Has no doubt disease is occasioned by bad water and bad conservancy. P. 330, Q. 5703–5721. The natives do not use latrines, and the excretæ, therefore, after rain get washed into the tanks by percolation through the soil. The

[N.B.—See note p. 201 *ante*].

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Europeans get the same water, though there be no communication between the lines. P. 333, 5782–5789.

Dr. WALLICH—, states that the water at Berhampore is charged with organic matter, which is washed into the tanks during the rains. Would recommend the storing of rain water in iron tanks. Considers the minute particles of animal and vegetable matter produce fevers, dysentery, and cholera. Considers the vegetable scum and film injurious when passing into a state of decay. The natives have no idea of sanitary precautions and are filthy in their habits, polluting the water. Filtration would be difficult on a large scale and more expensive than storage. Continued boiling would be the greatest safeguard, but these organisms will stand an immense amount of heat and are apt to grow again. P. 335, Q. 5836–5860.

Serjeant-Major WALKER—, describes the water at Calcutta as dangerous and not fit for use ; is certain numbers of men are killed by it. It is generally good at other stations. P. 346, Q. 6133–6136.

Dr. EATWELL—, doubts fever being produced by bad water, which, however, would cause cholera, &c. Suggests chemical examination of the waters of those districts where fevers prevail. P. 481.

V.—COMMISSARIAT ARRANGEMENTS.

COMMISSARIAT ARRANGEMENTS.

Sir R. MARTIN—, considers the ration to be satisfactory as supplied by the commissariat. Spirits are allowed, and it is difficult to enforce restrictions on their use in the bazaars. Malt liquor would be preferable, and it has been brewed at some of the hill stations with tolerable success. Tea, coffee, and cocoa are issued. P. 3, Q. 55–70. Spirits are always prejudicial, except, perhaps, on full march, after eating. Pp. 17, 274.*

Colonel SWATMAN—, thought the ration very good, but more meat than a pound a day was desirable for growing youths. Beer and spirits are sold at the canteen under regulation. They are not allowed to be sold in the bazaars, but this is evaded ; and it would be undesirable to prevent the sale of spirits at the canteen, as the men would resort to the bazaars. Licences are granted to natives, which should not be done. Beer brewed in India will not keep. The habits of the soldier as to temperance are somewhat improved. P. 44, Q. 422-467.

Mr. A. STEWART—, thinks the ration is very good. The soldiers generally drink arrack with water and malt liquor. P. 61, Q. 784 and 793. The sale of spirits should be discouraged, but not forbidden in cantonments ; there are times when spirits are desirable. Besides, if the men were not allowed to purchase them, and became discontented, smuggling of inferior spirits would be the consequence. An increased use of malt liquor in lieu of spirits was attended with very marked beneficial results at Meerut 1851–5. It would be advantageous to watch the men by the corporals, to observe their general habits, especially during epidemics. Pp. 61, 62, Q. 802–806.

Dr. RENNIE—, considers that food, both as regards quality and quantity, should be adapted to climate, just as clothing should be so adapted. As oxygen is the essential element of life, the quantity of which varies according to climate, the quantity of food required must vary also. From 30 to 35 ounces is sufficient for labouring men in England, but soldiers in England get 48 ounces, hence they have much disordered digestion, though the mean temperature is 50°. In India, however, with

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* See p. 32, "Fourth," &c.

[N.B.—See note p. 201 *ante*].

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the thermometer at 87° in the shade, the soldier gets 52 ounces; and much of what is called tropical disease is owing to this over-feeding. This state of things is aggravated by the use of spirits and tobacco. Considers that the lungs are impaired in this manner by a species of hypertrophy resulting from excessive nutrition. Recommends that the quantity of animal food be reduced, and all fat oily substances avoided. Bread and vegetables should form the staple, with a moderate allowance of fresh meat; ventilation should be carefully enforced. Smoking should be relinquished as a condition of entering the army. Considers the use of alcohol a common cause of sunstroke, which is also induced by the use of tight belts obstructing the action of the viscera.* Thinks all weight should be sustained from the shoulders. Addendum, No. 2, pp. 72–76.

Lieut.-Colonel GALL—, considers the soldier's ration ample, embracing meat, bread, vegetables, sugar, tea, rice, salt, and firewood, issued at about 5*d.* a day. Latterly even a pound and half of meat was allowed, more than the men could consume; they can exchange with the cook. The usual beverages are spirits, porter, and arrack. The spirits are sold with water at the canteen; the men are not allowed to drink it elsewhere. Thinks if the spirit rations were discontinued the men would clandestinely procure the cheap spirit of the country, on which a man may get drunk for a halfpenny. Occasionally at present the men exceed a little after receiving money. The usual issue is one quart of porter and one dram; the latter may be exchanged. Porter is cheapened to encourage its use in lieu of spirits. The habits of the soldier have improved, and they are consequently more healthy. There is less mortality and invaliding. P. 78, Q. 943–961.

Dr. McLENNAN—, considers the cooking arrangements in the Bombay barracks very deficient; the rooms are small, inconvenient, and without chimneys. The ration is good and sufficient. It would be the fault of the regimental authorities if bad provisions were taken. Thinks it very important that the use of spirits should be altogether disallowed; and that beer is also injurious, though producing a different class of disease. The canteen should be supplied with ice, soda-water, &c. Intemperance, though not always traceable, much increases the difficulty of treating other diseases, so that the number injured by it cannot be calculated. Nevertheless, during ten years, 1846–56, one-tenth of the cases in the European General Hospital, Bombay, were from delirium tremens and ebrietas—a larger number than from any other disease, fever excepted; whereas there were more deaths from alcohol than either fever, hepatitis, or diarrhœa, and nearly as many as from cholera. Nevertheless the soldiers have very much improved of late years in habit and character. P. 90, Q. 1228–1231.

Dr. COLVIN SMITH—, thinks the rations are good and well cooked. There might be more variety in the way of vegetables. Spirits are issued to the men in the field, which would be better discontinued; beer should be substituted, and would be a great saving in the long run.

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* The Thyet Myo Committee recommend that a strict register be kept of all spirit drinkers, and the date of every dram they take, as a help to the men to break themselves of the habit. (Appendix, p. 565.) Mr. Hare, remarks that the effect of some of the native spirits is to drive men mad. The quantity of animal food is far too great, and the men often complain of this. In the navy, the scale is 35½ ozs. of solid food, of which only 9½ is animal, while the soldier gets 16 ozs. of meat. In Burmah, the sailors withstood the climate much better than the soldiers, who longed for the pea-soup and pudding eaten by the former. (Appendix, p. 185.)

[N.B.—See notes pp. 201 and 202 *ante.*]

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Grog was often given in the morning before starting on the march, though against orders. The men who had been habituated to this would grumble, were it stopped suddenly. The medical officers' recommendations in such cases are not always attended to, the men's tastes being consulted. Coffee in the morning should be substituted for the dram. P. 101, Q. 1432–1458; p. 102, Q. 1523, 1524.

Major-General GOODWYN—, can suggest no improvement in cooking arrangements, except asphalte floors for cleanliness. P. 110, Q. 1782–1784.

Dr. MACLEAN—, considers the soldiers' habits very unfavourable to health. They are very intemperate. P. 141, Q. 2354. Has witnessed very sensible effects from disuse of spirits in temperance regiments. Much depends on the commanding officer. P. 143, Q. 2390–2392.

Dr. MCCOSH—, thinks every care is taken as to the soldiers' rations. Spirits are served out at the men's option. Ale might be more generally introduced. Very good ale is brewed in the hills, and the whole army might thus be supplied if a heavy contract were insured by Government, by which a quarter of a million annually might be saved on ale alone. The cooking is satisfactory. P. 151, Q. 2582–2596, 2629.

Sir JOHN LAWRENCE—, considers that the soldiers eat too much animal food, and drink too much. They eat meat two or three times a day. They buy bacon and pork with extra money. It would be advantageous could they be induced to eat less meat, and more vegetable food. P. 182, Q. 2942–2948. Thinks very fair beer is brewed in the hills, but that it would not keep any length of time in the plains. P. 196, Q. 3001-3003. These habits of repletion greatly increase the mortality. Europeans who are sober and temperate do not suffer in anything like the same proportion as the soldiers. P. 198, Q. 3033–3036.

Col. GREATHED—, can suggest no improvement in the ration; the soldier is very well fed. It is the fault of the commanding officer if he is not. Prior to 1854 the decision of the regimental committee, which is now final, might have been referred to a ration committee. The meat is the best grass fed; and 8 oz. of vegetables are supplied when obtainable. They get fruit also. The cooking is done by the natives, who are good servants. The utensils are tinned every month. The men live much better there than in England; there is no comparison. Care was required to prevent their exchanging the rations for bacon. In the 8th regiment the men were allowed to take money instead of the ration, with which they were better pleased, and provided themselves better. Spirit is sold only in the canteen under strict regulation, and served out on the march once or twice a day at the discretion of the commander. The police regulations are good, and there is consequently little drunkenness. Would abolish the sale of spirits if possible, substituting beer, but it would be difficult. The loss of the canteen fund provided by the tax levied on the soldiers' spirits would be one obstacle. From this fund amusements are paid for, &c. The English beer is better than that brewed at Mussourie. Pp. 202–204, Q. 3136–3200.

Dr. BIRD—, considers the cooking arrangements generally deficient, though the ingenuity of the native cooks tend to supply this defect. The men should be well dieted in India, the appetite being capricious. They are better fed than in England, having greater variety in cooking, spicing, &c. Thinks the waste of the constitution being greater in hot climates, the diet should be more nutritious. A pound of meat is sufficient. Vegetable diet is preferable in many respects; would re-

[N.B.--See note p. 201 *ante.*]

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commend the abolition of rich aliment and stimulants for newly-arrived Europeans to facilitate their acclimation. The arrack ration is a great cause of ill-health, and should be discontinued. Beer is better ; but not so good as light wines, sherbets, effervescing water, &c. Cape wines are cheap. After the effect of the change is past, does not think the present ration excessive, and the men would regulate their consumption by their amount of exercise. P. 217, Q. 3512-3540.

Brig.-Gen. RUSSELL—, states that on first landing at Moulmein the men got an injurious Chinese spirit called shamshu, from just behind the cantonments, also fresh pork, which together produced dysentery among them. P. 226, Q. 3691, 3692. Every effort was made to draw men from the canteen, which was kept as far as possible from the place of amusement. The men preferred going thither and getting their porter fresh to having it brought to them at dinner. They cannot get more than two drams of spirits, which they regard as a right. Thinks discontent would follow its reduction. It would drive them to the bazaars for liquor. There should be no excuse for drunkenness, which should never be overlooked. Pp. 229, 230, Q. 3779–3790. Sufficient care is not taken in some regiments as to what the men eat, *e.g.* bad pork, eggs, and fowls, which perhaps died of disease, and toddy is brought into the barracks. In the 84th regiment men had a contract for 8 oz. of mutton and 6 oz. of bread beyond the full ration. The men do not like salt rations, preferring inferior fresh meat. P. 233, Q. 3895–3900.

Colonel CAMPBELL—, suggests that there should be a trained commissariat. There is no special corps. These officers being selected from regiments, some are exceedingly good, others as bad, and there is a great obstacle in the way of procuring good rations. At Umballa impure bread was supplied, and for months the regimental committee was thwarted by the brigadier, who ordered a station committee, thus plainly disobeying the general order that the regimental committee should be final. Some commissariat officers never had a bad loaf, others could never get a good one. The 52nd regiment was well supplied during the mutiny, being connected with a very excellent commissariat officer. There is no difficulty in getting supplies on the march. Had known attempts made to bribe officers, which is a thing to be guarded against. A certain quantity of spirits may be served at the canteen, but many do not take it. The previously confirmed drunkards in the 52nd relinquished their intemperate habits on landing in India, which could not be accounted for. The withdrawal of spirits would produce discontent and be rather mischievous. Bottled beer ought to be sold ; it was prohibited by order, and was a great deprivation, as in hot weather the draught beer which is sent out gets flat. Beer was brewed at Meerut by an officer to great advantage ; but as a matter of pride this was not approved, and it was discontinued. The beer was not liked so well as the English. The 52nd were very temperate in India. There was not one case of delirium tremens or injury from drinking. It was most extraordinary. Discipline was strict, and the police excellent. Pp. 241, 242, Q. 4064–4108.

Dr. R. D. THOMPSON—, believes that the absence of cool water inclines the men to intemperance. It has been proved from the mortality tables that abstainers have an advantage of 19 per cent. over those who drink. P. 276, Q. 4877–4879.

Commissary-General THOMPSON—, states that the commissariat service is in substance a special one ; the officers being selected and

[N.B.—See note p. 201 *ante.*]

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nominated on probation for a year, when they pass an examination and are then permanently appointed, and serve on an average from 20 to 25 years. If inefficient they are turned out. They have no voice in receiving or rejecting the rations. The quality of supplies depends entirely on the commanding officer, who can reject bad provisions, the contractor being bound under penalties and forfeiture to supply good articles, and the regimental decision is final. There is sometimes a difficulty in getting good bread, but after five rejections within 30 days the contract is annulled, so that inferior bread ought not to be taken. The commissariat officer inspects the rations, but has no power to reject without the military authorities. The commissary-general makes the contracts. It is imperative by the regulations to accept the lowest tender unless anything is known against the contractor. The hospitals are supplied in the same way. The meat is the best grass-fed beef five days, and mutton twice a week. The men employ their own cooks. Beer is sent from England. There are breweries at Kussowlie and Mussourie, but the men do not like the beer so well as English, though it is cheaper. Beer is sold to the soldier by the Government at a loss amounting probably last year to 25 lacs of rupees (or 300,000*l.*) Complaint is sometimes made of the grass-fed mutton for the hospitals. It is perhaps not good enough for sick men, but if rejected none so good of the same kind could be procured in the market, and there is nothing else to be got. Gram-fed sheep are eight times the price of grass-fed. The commissariat also carries tents, baggage, and everything on the march. It is difficult to get vegetables at all seasons; potatoes are expensive, but are supplied whenever procurable. Complaints are made when these cannot be obtained. Vegetables are important, and seeds of all kinds have recently been sent to each station for the purpose of raising their own supplies. Considers the regimental bazaars better than free markets for supplies. Would prefer doing away with the contract system, making the commissariat officer solely responsible for the quality of articles supplied. Native hospital nurses are very attentive. Believes they give satisfaction. Pp. 279–283, Q. 4951–5090.

Dr. SUTHERLAND—, considers the ration is ample, and being chiefly consumed in the middle of the day, without exercise, predisposes to disease. Cooking arrangements are defective. The habitual tippling of spirits ought to be put an end to. P. 313, Q. 5494.

Sir A. TULLOCH—, recommends that beer should be brewed at the hill stations in India, as the Government are now paying 200,000*l.* a year for beer. Hops and barley may be raised there. What has been hitherto tried has not been by professional brewers. Food, generally, might be procured cheaper in the hills than on the plains. P. 325, Q. 5650–5658.

Dr. MOUAT—, states that the natives feed themselves, and generally buy the cheapest food, being very penurious. They are apt to suffer from changing from wheaten bread to rice. P. 331, Q. 5724–5726.

Serjeant-Major WALKER—, states that the soldier is better fed in India than in England, there is far greater variety, in cooking especially. The bread has much improved of late years, also the supply of vegetables, which is now abundant. Beer is also plentiful and good, and cheaper than in England, being sold at a loss to the Government. Each man may draw two drams of rum, or one dram and one quart of beer per diem. Native spirit is sometimes smuggled into the stations and kills many men, but the military police regulations are

[N.B.—See note p. 201 *ante.*]

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now so much improved that it is difficult to evade them. Still drunkenness may often occur through neglect or mistake on the part of non-commissioned officers in charge of the canteen, also by the men giving beer drawn for their own dinner to their comrades, who may thus get too much. Although much intemperance, there is less among the men in India than England, and less crime. The men would not like to be debarred from the use of spirits, unless first persuaded that it would be best for them. Familiar lectures by medical officers would be beneficial for this purpose. P. 338, Q. 5923–5982.

Dr. DEMPSTER—, states that, as regards food, the English are apt to continue their old habits of diet in hot climates, which is unnecessary and injurious. Points out contrast between English and French in this respect at the Mauritius, and the much greater amount of disease among the former in consequence. In India Irish recruits consume many times the bulk of animal food they did at home, yet an equal quantity cannot be taken with safety. Vegetables are now supplied as part of the ration, which has been altogether improved; but there is yet too much animal food. The cookery is too gross, and pork from ordure-fed swine is eaten. Drunkenness promotes the invasion, and retards the cure of every tropical or other disease. Always endeavoured to discourage the use of spirits. Instances the fact of a troop of horse artillery, which at one time had 50 per cent. in hospital, after the introduction of temperate habits at Meerut (only 20 then drew spirit rations), marching to Sealkote with a clean bill of health, no death having occurred for two years. Advises pure water or slightly acidulated drinks only in general, but in some cases pale ale, *i.e.*, for weak persons after several years' residence. P. 466. Rum made in Bengal is usually consumed. The bulk of malt liquors is objectionable. Would recommend abstinence from all such stimulants, and tea and coffee as substitutes. Is acquainted with officers celebrated for powers of endurance who confined themselves to cold tea. The smuggling of arrack already occasions much trouble, and its prohibition would occasion further loss of revenue. It is difficult to keep ale imported from England. Porter keeps better. Had examined and tested beer made in the hills at Mussourie by Mr. Mackinnon. It was much liked and in good demand. Pronounced by special committee to be good and wholesome. Some put aside in bottle through the hot season was afterwards found perfectly good and quite transparent, after standing in the glass 12 hours. P. 476. Unbolted wheat meal bread should be provided for the troops in preference to that made from "soojee," the preparation of which he describes. P. 479.

Lieut.-Col. OUCHTERLONY—, gives results of his experiments in brewing on the Neilgherries, the beer having been approved by those who tried it; so that the trade would pay professional brewers if supported by Government. Adds return of loss by getting beer from England. P. 482.

VI.—DRESS AND ACCOUTREMENTS.

DRESS AND ACCOUTREMENTS.

Sir R. MARTIN—, is of opinion that enormous improvements might be made in the military dress, and that it is most important to determine what is the best covering for the head.* Thinks flannel should be

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* The Hurryhur Committee consider the general style of the "Zouave" dress most suitable for India, and recommend a helmet of "rumdah" in preference to wicker-work. (Appendix, p. 505.) The Bangalore Committee condemn the khakee clothing, and recommend serge or flannel tunics, and holland trousers; also felt helmets, in preference to wicker. (Appendix, p. 332.)

[N.B.—See notes pp. 201 and 202 *ante*.]

Dress and Accoutrements.

generally worn both day and night, as a protection from sudden changes of temperature. The soldier in India carries from 40 to 60 rounds of ammunition, but the knapsack is conveyed in carts. The march is usually at night. P. 3, Q. 75–87.

Mr. A. **Stewart**—, thinks alterations in the dress are very desirable. The metal helmet should never be worn in India. Neglect in this respect is apt to induce sun-stroke. Wicker helmets and shakos are now being introduced. Considers the constant use of flannel highly important; also loose summer clothing. Thinks a double felt helmet the best, with inner chamber and air holes, and having quilted flannel covers with curtains for protection from the sun. P. 63, Q. 809–815.

Dr. **Rennie**—, considers that all weight should be sustained from the shoulders. Sun-stroke is often induced by the action of tight belts impeding the action of the viscera. Addendum No. 2, pp. 72–76.

Lieutenant-Colonel **Gall**—, thinks the cloth tunic admirably adapted for 10 months in the year; in hot months a canvass frock is worn, and a wicker helmet is now worn. Approves of flannel next to skin. A light turban over the felt cap or helmet is useful to keep off the sun. The hussar boot is preferable to trousers and Wellingtons. A light waterproof cloak with hood would be serviceable.* P. 79, Q. 982–986.

Dr. **McLennan**—, suggests that red flannel shirts might be substituted for cotton. The coat could not always be worn over it. For the head lightness is of less importance than protection from the sun. P. 88, Q. 1212–1216.

Dr. **Colvin Smith**—, approves the dress recently introduced,—a dust coloured dress without a stock, and a covered wicker helmet. The flannel used is too hard and hot; would have a lighter kind. Soldiers do not like flannel. Would recommend the wearing of a cummerbund, even more than a cholera belt. P. 102, Q. 1487–1499.

Mr. **Julius Jeffreys**—, recommends the adoption of double ventilating helmets (weight being of minor importance, if ventilation is free) and gives three models of different kinds. The exterior should be bright to resist, by reflection, the sun's rays, the interior capable of being loosened or made tight to any shaped head by the turn of a screw, and protection afforded both for the eyes and for the neck. Cane-work perhaps the best foundation. A proper hat would save numbers of lives. Soft flannel should be universally worn, and a loose tunic or curtain to protect the spine should be suspended a few inches from the back. P. 180–187, Q. 2860–2886.

Colonel **Greathed**—, considers the present dress excellent, and can suggest no improvement. It consists of a khakee tunic and trousers, with no stock, except in cold weather, and a helmet of wicker work. English boots are used. A greater number of sizes might be made with advantage. They are now always taken to pieces and remade, to fit the men at their own expense. But they march well. Has seen 40 or 50 men after a march go out shooting the whole day, and begin again next morning. There should be a halt after the first half hour to enable the men to adjust their shoes, which is one of the most im-

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* Mr. Hare deems the waterproofing of great coats and shoes of great importance, and gives simple and effective recipes for accomplishing the desired end. (Appendix, p. 186.)

[N.B.—See notes pp. 201 and 202 *ante.*]

DRESS AND ACCOUTREMENTS.

portant halts of the day.* Has marched 300 miles with men without one straggler on the line. P. 206, Q. 3238–3250.

Dr. BIRD—, considers that woollen should be worn next the skin by the soldiers, as much injury arises from throwing off clothing, and getting chilled after violent exercise. Such fabrics as are made in Scotland are better and cheaper than flannel, which shrinks. There should be a coloured cotton dress for hot weather. The wicker helmet, with a white cover, is the best head dress. The cummerbund is very useful. P. 218, Q. 3557–3573.

Brig.-Gen. RUSSELL—, objects to the infantry shako as not protecting the temples and back of the neck, and so hard that if not constantly in use it cannot be got on the head. The soldier does not care what weight is on his head, and generally fills his shako with something. The helmet now issued is better. Every man should have a cummerbund instead of belt or braces. The great coat does not turn off the water; a shower soaks it through. A better cloth would be cheaper in the end, and more conducive to health. The trousers are too small, and of thick, hard, woodeny material. Tweed or tartan would be better. The stock should be discontinued. Would not recommend knickerbocker leggings. The soldier must be dressed not only for service, but to walk the bazaars. The natives make comfortable shoes, which the men always wear, except in wet weather, when they are glad to put on their ammunition boots. Never found more than five or six men who could not be called fitted from the sizes of the latter sent out. As the sea voyage spoils the stitches, they are generally re-sewn. P. 231, Q. 3810–3835.

Mr. BISHOP—, considers the superiority of the knapsack invented by Mr. Berington over that commonly in use to be clearly demonstrated by the fact that, when properly adjusted to the figure of the man, the weight is felt only on the shoulders, whereas in the old pack the strain is chiefly upon the lower part of the back. The new knapsack having its axis resting on the transverse plane of the body, it is not necessary for the wearer to bend forward, as he must with that in ordinary use, to compensate for the weight behind. The arms also are quite unimpeded. It does not interfere with the action of the chest. If any such inconvenience has been felt, it probably arose from the manner of adjustment. An instructor would be necessary at first to explain to the men how it should be adjusted. The waist or ammunition belt, also invented by Mr. Berington, enables a man to carry a greater weight with more ease. It fits nicely on the brim of the pelvis, by which greater freedom is obtained for the trunk. P. 302, Q. 5363–5389.

Serjeant-Major WALKER—, has heard no complaints in reference to the clothing. The khakee dress is most suitable for Indian service, the men often make it for themselves. Flannel shirts and belts are generally worn. The ammunition boot is the best for India. The blue trousers are liked from being easily washed. Canvass leggings are advantageous for drill, and on the march. The best head dress was the Kilmarnock forage cap with padded calico cover and turban fastened round it; it was sword proof, and made a good pillow at night. The wicker helmet, though cooler, is awkward and not so

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* The Ahmednuggur Committee advise that care be taken that boots and socks fit, when, if the heel and instep be rubbed with common brown soap each morning before march, and shoes and socks taken off before crossing streams, foot sore may be entirely avoided. (Appendix, p. 842.)

[N.B.—See notes pp. 201 and 202 *ante*.]

DRESS AND ACCOUTREMENTS.

suited for actual service. The stock is discontinued in India, nor is the knapsack used as a general rule. The present equipment is as good as well could be. P. 341, Q. 5984–6013.

Dr. DEMPSTER—, considers that as the variations of temperature between early morning and noon are so great, that both warm and light clothing are requisite on the same day. The thermometer is often 36° or 40° in the morning, and 70° or 80° at two o'clock. The neck especially in such seasons should be perfectly free. If flannel has not previously been worn, it may be dispensed with on arrival in India, but after several years' residence, the system being more sensitive, a light flannel shirt will be a safeguard. The flannel supplied to the soldier is too coarse and irritating; improvement in this respect is desirable. P. 467.

VII.—REGIMENTAL DUTIES.

REGIMENTAL DUTIES.

Sir R. MARTIN—, thinks the regulations as to drill are good and pretty uniform. P. 3, Q. 71. Recruits generally arrive in robust health, probably too plethoric for the climate. They should be drilled before going out, and be about 23 years old. They should be exempted from over-exertion for the first year after arrival. The saving of life would more than repay the additional cost. P. 7, Q. 179–192. There is no furlough for the men; the officers alone get sick leave and furlough, the latter has recently been extended to non-commissioned officers. P. 8, Q. 207–210. Regiments generally remain about 15 years in India. There is not much difference in the age of the men of the two services. Recruits on arrival should be sent to head quarters at once. P. 17, Q. 271, 272.

Colonel SWATMAN—, stated that at gun-fire, probably five in the morning, the men go on parade for an hour and a half before breakfast; after breakfast they are wanderers, except that the cleaning of arms occupies some time. They have two hours sentry duty. The roll is called after dark, at gun-fire. Ordinarily about one night in 20 the soldier is on night duty. P. 45, Q. 495–501.

Dr. STEWART—, (Surgeon of Warley* Depôt,) considers that many recruits go out to India too young. The usual age is nominally from 20 to 25, but is satisfied many go under 20, representing themselves older than they are. P. 48, Q. 593–601.

Mr. A. STEWART—, thinks that drilling should not take place in hot weather; has often observed injurious effects from this; the men break down and the hospitals are filled. From the middle of October till March drill and field days should take place; at other seasons, parades and quiet movements only. Men should be sent out drilled, and not

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* There were 851 persons of all ages at Warley, on 1st December 1859. The barracks are calculated for 1,500 men; every sanitary precaution being provided, and well furnished lavatories for the men. The establishment is extremely healthy; many men bring disease with them (even small-pox), which explodes a few days after arrival. The hospital has 10 wards for 10 patients each, giving 783 cubic feet space per man. Average per-centage of sick is 6·50, more than half being venereal cases. The mortality is very low, only 2 out of 600 last year very soon after their arrival. No better or healthier men could be found than the men who have embarked during the last two years, nevertheless some were returned from India as unfit. Some of the district surgeons are more particular than others. Before 1857 the usual time for keeping men at the depôt was from four to six months, during which time they were thoroughly drilled; it was then (1859) only six weeks. Every man previous to embarkation is specially examined by the depôt surgeon, and may be kept back or discharged. P. 48, Q. 605–611; see also Addenda, p. 51.

[N.B.—See note p. 201 *ante.*]

REGIMENTAL DUTIES.

under 20 or 25 years of age. Courts-martial in the hot season, when witnesses, &c. are kept waiting, should invariably be held early in the morning. P. 64, end of Q. 815–826.

Dr. RENNIE—, is of opinion that men of strong constitution alone should be sent to India. Recruits are frequently enlisted of weak constitution. None who have not previously served five years should be allowed to embark for India. For this purpose each regiment should have a second battalion, to be called the Indian battalion, into which the healthiest men may be drafted. But, above all things, habits must subsequently be carefully attended to, as eating, drinking, and smoking are the chief causes of premature death in India. Addendum, No. 2, pp. 72–76.

Dr. McLELLAN—, considers the marches well regulated; 75lbs. of baggage is carried for each man. P. 88, Q. 1217–1219. Recruits should not be too young, not under 21 or 22; 17 is the best age for cadets. Officers only are allowed sick leave from 15 months to 3 years; the men are only sent home when unfit for service. Thinks the plan of paying officers too highly, for the first six months of leave only, a bad one, as it tends to drive them back before recovery. It would be better to divide the amount over the whole period, and the furlough should be extended to two years. Privates should be superannuated at 40, warrant officers at 50, and commissioned officers at 60, with a dispensing power in exceptional cases. Pp. 93, 94, Q. 1294–1306.

Dr. COLVIN SMITH—, thinks the men are often drilled too long, exposing them to the sun; an hour and a half in the morning and an hour in the evening five days a week, during favourable weather, in the cold season would suffice for made soldiers. There should be little drilling in hot weather; there is guard mounting besides. Pp. 101, 102, Q. 1468–1477. Fifteen years should be the maximum length of service for men in India, commencing at the age of 21 or 22 (they might still serve at home, the Cape, or Canada). Men are seldom seen above 40. It is the drilling of youths of 17 or 18 on the plains which kills them. They should be drilled in England. P. 105, Q. 1611–1620.

Dr. MACLEAN—, advises greater attention to regularity, reliefs, and marches, so as to give the shortest possible journeys, as the fatigue and exposure greatly predisposes to cholera, insolatio, and other diseases. P. 144, Q. 2415–2420.

Colonel GREATHED—, has observed that the men of the Indian European infantry worked better in the sun than the Queen's regiments; has heard as a reason that the recruits were rather older; the men with whom he served were, as a rule, very careful and strictly obeyed orders; there were few exceptions. P. 200, Q. 3076–3081. Can suggest no improvement in the regulations, which should be acted up to with strict attention. The check-roll at night is not often called; the men are on guard 24 hours, and are 13 to 15 nights in bed for one out. There is less fatigue duty than in England, as they have sweepers, cooks, washermen, and water carriers. All other followers were got rid of. P. 207, Q. 3251–3260. Does not think the frequent removal of regiments desirable; it involves much expense to the officers; three years should be the minimum, in which time they may be cleared from debt. European troops do not domesticate by length of residence. It might be unfair to keep a regiment too long at an unhealthy or unpopular station. A change is an advantage in a military view, as a march is a campaign in India. It would be better that recruits should

[N.B.—See note p. 201 *ante.*]

REGIMENTAL DUTIES.

not commence service in India before they are 23, but youths enlist more readily, and we have not men enough to be able to afford to keep them several years at home. They would not enlist for the service generally, but like to have a choice of a regiment. Has seen recruits quite as healthy as old soldiers. P. 208, Q. 3282–3302. After six or eight years' service a man is not so good as he was. Believes the deterioration mainly arises from a life of inaction; this would be improved by gymnasia. P. 209, Q. 3304–3308.

Dr. **Bird**—, is of opinion that marches should be arranged under medical regulations; they should commence before sunrise, so as to arrive by eight o'clock or earlier in the hot season. Men do not sleep in the day after night marches. P. 224, Q 3584–3588.

Brig.-Gen. **Russell**—, considers from 19 to 22 the best age for recruits, who should embark so as to arrive in India at the commencement of the cold season, and be sent at once to depôts on the hills for a couple of years, until fully set. This would be far superior to having depôts at home; cheaper, with less sickness and debauchery, and no desertion; they would be finer men and longer efficient. At home, diseases of the heart and lungs are contracted by lads from carrying knapsacks, over drilling, and night duty before being fully developed; 23 is quite early enough for full work. P. 232, Q. 3880 and 3895.

Colonel **Campbell**—, states that the soldier is much better off in India than at home as far as duty goes, and has nothing to complain of; there is nothing in his ordinary service in the least injurious to health. P. 244, Q. 4148, 4149. There is no advantage in frequent changes of station, but if a regiment has suffered much in a place a removal would relieve the men's minds. A march is not injurious, the 52nd marched three months continuously; the men did not suffer, but the removals should be at less distance; *e.g.* this regiment has recently moved from Sealkote to Jhansi. Recruits might begin duty at 20, the length of service depends entirely on the men; some are better after 20 years' service. Men unfit for India might serve in another climate; he would bring home regiments after seven years, sending out no reliefs in the meantime; but rather taking out 1,500 or 1,200, and bringing home whatever were left. Recruits from depôts are sent out, and over the country at enormous expense, do much mischief, and are useless for a year or two in spite of any previous drill. Condemns the volunteering system entirely as bad; it might be as well to allow those who wished, to volunteer into other regiments, but he would preserve the unity of regiments as much as possible. If 700 came home out of 1,200, they would form a good nucleus. Under this system it would become a point of honour with commanding officers to bring back their regiments as complete and unthinned as possible, and it would be an excellent test as to the effect of the climate and management; the men's interest would remain at home, they would retain an object in life, and there would be fewer married. Men would be more likely to re-enlist if they knew they were coming home, and thus remain in the regiment; 10 years' enlistment is too short, would give a pension after 16 years. Would not allow more married men, nor allow marriage with natives; there is caused great discomfort by being obliged to leave the families behind when a regiment is on service. P. 244, Q. 4167–4208.

Mr. A. **Grant**—, considers that 10 years is a fair time for service abroad; would advocate frequent removals from unhealthy stations, but not from healthy ones, on account of the expense; the troops should

[N.B.—See note p. 201 *ante.*]

REGIMENTAL DUTIES.

be grouped in healthy stations, where they may remain several years without injury. P. 264, Q. 4536–4538.

Colonel DURAND—, does not think the service unpopular among soldiers in India. Men are always glad to move, as it breaks the regularity of their lives. Always, when regiments are relieved, many, both officers and men, are inclined to remain in India and exchange into other regiments, especially those who are married. P. 283, Q. 5096–5101. The sanitary arrangements in the field are fully adequate and satisfactory. With regard to exposure of the men, hours of drill, efficiency, &c., much depends on the wisdom of the commanding officer, with whom all internal arrangements rest. Circumstances vary so much that it would be better to leave the responsibility upon the commanders-in-chief and adjutants-general to see that commanding officers do their duty well, than to lay down precise regulations. General officers' inspections are very trying to the men, as they are kept standing a long time in heavy marching order, by which they suffer more than when moving. The object would be better attained by placing the knapsack and kit at the feet of each man. Very great discretion should be exercised as to keeping the men standing. P. 287, Q, 5141–5154.

Sir A. TULLOCH—, considers 18 a good age for recruits, provided they be drilled for two or three years at home, where it can be better done than in India. P. 318, Q. 5555-5557.

VIII.—RECREATION AND EMPLOYMENT WHEN OFF DUTY.

EMPLOYMENT OFF DUTY.

Sir R. MARTIN—, considers that exercises and amusements for the soldier should be more systematically arranged, instead of being dependent on the will of officers. Indoor amusements and trades have been sometimes encouraged, with good moral benefit. The soldier should do for himself whatever he can do without injury to his health or discipline.* P. 3, Q. 71–74; p. 17, Q. 273.

Colonel SWATMAN—, stated that the usual outdoor amusements are provided for the men; also libraries, which are much used, and the schools are well attended. There are gardens at some stations—all vegetables grow well. There are no workshops, which might be introduced with the greatest benefit, as well as preventing idleness and *ennui;* the only difficulty would be in furnishing materials at first. P. 45, Q. 468, 485. Frequent changes of station and regular exercise on the march are very beneficial, but on the ground of expense, thinks once in three years often enough for change of station. P. 47, Q. 539–547. Thinks the men do too little, and that more employment would be advantageous in diminishing crime and courts-martial. P. 47, Q. 580–583.

Mr. A. STEWART—, suggests that tables between the beds, where room should be allowed for reading and writing, should form part of the barrack furniture. P. 55, Q. 681.

Lieut-Colonel GALL—, states that the amusements provided for the men are cricket, bowls, fives, dancing, theatricals. In the hot season they are not allowed to go out in the sun. The library and school are much used. There are flower gardens at some stations, which are

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* Colonel Robertson recommends that soldiers in the hills should perform all offices for themselves as in England. The experiment was successfully tried in the Sikkim campaign. Addendum (P. 486.)

[N.B.—See note p. 201 *ante.*]

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useful and much liked by the men. Workshops would be very advantageous, but the men do not like to risk buying tools; they should be provided for saddlers, tailors, printers, shoemakers. Thinks the men might make money; the danger is how they might spend it. Men who spent their earnings in drink should be forbidden to work, and the sober men encouraged. Many men in every troop had accounts in savings banks; the habit increases. Shady places are not generally provided for the men. In hot weather they are confined to barracks from 9 a.m. to 5 p.m. and suffer from *ennui*. P. 79, Q. 962-981. Covered fives courts, gymnasia, and workshops for the men should be supplied. It is very important that a regiment on a distant expedition should be furnished with artificers so as to be able to supply their wants. Annual exhibitions might be held as an encouragement to workmen and for sale of articles. Except the library, the soldier has usually no day room. Pp. 80, 81, Q. 1013-1020.

Dr. McLENNAN—, states that, except games in the barrack yard and libraries, there are no means of recreation provided at Bombay. There are gardens at some stations; he suggests that prizes might be given for best productions.* Too much restraint has an injurious tendency. P. 88, Q. 1108-1111.

Dr. COLVIN SMITH—, considers that trees for shade should be planted at all stations; has seen no sheds under which men can take exercise, though they exist at some stations. The men might be allowed to shoot, and encouraged to take more exercise. P. 100, Q. 1398, 1405. There are the usual outdoor games, which are generally connected with drink, but the men have not sufficient amusement mentally or physically; *ennui* and predisposition to disease are the consequences. P. 101, Q. 1459-1463. There should be workshops and gardens, also libraries, which are now very deficient, and reading and smoking rooms attached to coffee shops, &c. P. 102, Q. 1478-1486.

Major-General GOODWYN—, is of opinion that arcaded places under the barracks, for amusements, would be of great advantage to the health and comfort of the men. P. 111, Q. 1780.

Dr. MACLEAN—, thinks not half enough has been done to provide occupation and amusement for the men, who suffer much from *ennui;* there is a great difference among officers in attention to such matters. P. 141, Q. 2354, 2355.

Dr. McCOSH—, is of opinion that the soldiers would be greatly benefited by being employed on public works or in trades; their wages being deposited in regimental savings banks until they are discharged, or for their next of kin; there are a thousand ways in which they may be employed with advantage at all seasons in the hills, and four or five months in the plains. P. 152, Q. 2620-2628; p. 154, Q. 2685, 2686.

Mr. JULIUS JEFFREYS—, considers that the men might not only be employed in their respective trades with great advantage, but that any artisan might be allowed to take for his own benefit native youths as apprentices, to teach them useful arts, *e.g.*, ceramic, metallurgic, and chemical, of which the inhabitants of India are so ignorant, commencing with fire bricks, pottery, &c. There are no ploughs in India. To superintend various works, an ensign's commission might be given in

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* The Umballa Committee recommend that gardening be made an offset against other regimental duties, and all be obliged to take it in turn. (Appendix, p. 236.) Whilst the want of variety of vegetables is generally acknowledged, there is no point on which the station returns show more universal concurrence than that the men take no interest, personally, in garden work.

[N.B.—See notes pp. 201 and 202 *ante*.]

EMPLOYMENT OFF DUTY.

each regiment to a young man of science, with liberal allowances, so as to obtain the best talent, which would ensure greater and therefore more economical results. P. 188, Q. 2893–2901.

Sir JOHN LAWRENCE—, thinks that the men should be induced to work if possible, but they do not like working. There is difficulty also in selling their productions, being undersold by the natives; carpentering, shoemaking, and tailoring the natives would do as well at a much less cost; if there were a market, it would be a great inducement. Not one man in a hundred cares about reading. Thinks the mortality might be much reduced, and that *ennui* is one of the causes, also careless exposure. Gardening is not liked, nor any work; amusement is preferred. They would work if paid for it. It would be an apparent loss to pay them, but it would be repaid by better health, and the regiments might in some measure be made self-supporting. Thinks there would be an advantage on the whole in paying the men more. They are reckless and unhappy, yet soldiers who had been in India prefer it to home service. Pp. 191–193, Q. 2937–2962.

Colonel GREATHED—, states that libraries have been beneficial, but hopes to see reading rooms in the barracks, which are much needed. P. 204, Q. 3176. Men who cannot read fluently like to hear others read. The men of the 8th regiment were allowed unbounded liberty to shoot, which they did without suffering from the heat,* but they were not allowed to go in the hottest weather; it was their best amusement, and they were encouraged to go; they had also the usual outdoor games; there were 440 subscribers to the library, and about 260 of them attended school,—for which they also paid a small subscription,—besides recruits, who are taught gratis. It depends on the schoolmaster and commander. Gardens did not succeed, Englishmen do not care for gardens. Scotchmen were induced to take up gardening (having prizes offered them) by Lord F. FitzClarence. Men sometimes work at their trades, and might make a good living by it, but they do not work much, being already well off. Active amusement is preferred to work. There are no gymnasia. It would be a great advantage to have them, and they should be made a parade; it would be the best thing ever introduced into the army. The men should not be confined more than necessary. Large sheds should be provided, under which gymnastics could be practised at any hour. Pp. 205, 206, Q. 3203–3237.

Dr. BIRD—, considers covered places for racket and other exercises should be put up annually, as the rain was approaching. Day rooms would be of the utmost importance for chess, billiards, &c., both as regards comfort and health. P. 215, Q. 3465–3469. The men should be encouraged to work at trades by having tools provided by way of advance, to be paid for from their earnings. P. 219, Q. 3549–3556.

Brigadier-General RUSSELL—, states that skittles is the favourite game; men tire of gymnastics; trades were always encouraged in the 84th Regt., tailors, shoemakers, carpenters, and some others were generally in full work, besides clerks. Half the men were employed at Rangoon in levelling a stockade, and 250 at Jackatalla on new barracks; those employed made money and much improved in health and strength; occupation even out of doors and in the plains is better than a listless life in barracks; the erection of workshops would be a great

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* The Thyet Myo Committee consider labour and exposure to the sun in Burmah not in any degree injurious to Europeans. There should be no restriction in this respect, and workshops for different trades should be organized. (Appendix, p. 567.)

[N.B.—See notes pp. 201 and 202 *ante*.]

EMPLOYMENT OFF DUTY.

advantage, but their use much depends on the commanding officer. The 84th had a good library, and a reading room crowded daily from 10 till 4, it was supported by voluntary contributions, and well supplied with newspapers, periodicals, and books from Smith and Elder's sent out quarterly. There was a coffee-room. Glee singing, dancing, and theatricals were encouraged and made lucrative to the performers. P. 229, Q 3766–3778.

Sir P. CAUTLEY—, had understood from Sir Henry Lawrence that men do not take to gardens, they probably regard gardening as work rather than amusement ; there is no difficulty with Scotchmen ; the question of amusement depends much on the commanding officer. The provision of workshops for the different trades would be an admirable way of occupying the men ; the difficulty would be in procuring tools. Probably these might be furnished by, and remain the property of, Government without being removed from station to station ; understands from General Tremenheere that every barrack in the Punjab has a workshop and a reading room. Employment should be encouraged ; at Landour had found men glad to be employed in building, saddlery, &c.* Pp. 235, 236, Q. 3949–3960.

Colonel CAMPBELL—, states that a fives court is provided by Government, and there must be a school ; beyond that all means of recreation mainly depend on the commanding officer. The men are fond of newspapers and periodicals and new books. The same books remain too long, which makes them indifferent to the library ; they should be often changed. The 52nd Regt. had cultivated gardens, and provided tools, including turning lathes, printing presses, &c., but the regiment was soon moved and kept changing about, so that no result followed the labour, and the tools were all lost by degrees. If spacious workshops and tools were provided and kept at each station they would answer unexceptionably well, the same building well lighted might be used as an evening reading and refreshment room ; deficiency of light is a universal fault in India, and very much felt during the long nights. The same oil used in American reflecting lamps gave a very good light. The care of tools and workshops should be in the engineers' department. The men should manage their own trades union and appoint their own foremen ; the profits might produce a fund for materials after repaying the Government for the tools. The 52nd printed all their own returns, also papers for the civil authorities at Lucknow, and supplied the 81st with 100 pairs of boots, not otherwise obtainable ; the profits were received by the paymasters and divided according to the work done by each man ; they will not work for nothing. Covered sheds should be provided for each company as a protection from the sun by day. Gardens would be profitable in two years; the 52nd were never more than nine months at a station ; this was accidental. Pp. 243, 244, Q. 4113–4144.

Mr. A. GRANT—, states that the soldiers often complain of weary idleness. The Government might give them contracts for supplying shoes, clothing, harness, beer, &c. Tools should be supplied and gardens provided. P. 261, Q. 4470,4471.

Colonel DURAND—, considers that men dislike work only when it appears to them to be of no utility, and that those who volunteered might, when not required in the field, be usefully employed wherever there are magazines, which employment would increase their intelli-

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* *See* Addenda, pp. 238, 239, Letters from old non-commissioned officers stating that employment in trades would be the greatest boon to the soldier.

[N.B.—See note p. 201 *ante*.]

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gence. They might also be employed in building, but it can only be on work which will bear interruption for field duties. They would be paid for their labour. The establishment of station gardens might be tried, growing crops being handed over by purchase to incoming regiments. P. 284, Q. 5102–5121. The use of gymnastics would prevent much of the falling in of the chest, which is often noticed amongst infantry after long service in India. P. 288, Q. 5173–5177.

Sir C. TREVELYAN—, had proposed the building of a lofty iron shed, like a railway station, at Madras, under which there might be schoolrooms, library, reading room, tennis court, and other accommodation for amusements calculated to diminish the depression caused by the monotony of barrack life.* P. 291, Q. 5243. Would recommend such a building at all stations, as the men cannot walk out during the day; as compared with the object, the expense would be insignificant. P. 291, Q. 5247–5254.

Dr. SUTHERLAND—, describes the reports from India as indicating great deficiency in the means of recreation, instruction, exercise, and occupation, the only resource being idleness or vicious indulgence. P. 313, Q. 5494.

Sir A. TULLOCH—, considers the troops would be healthier if they were more employed in public works and fortifications. Workshops of light bamboo might easily be constructed in India, and gardens provided at each station, from which vegetables might be sold to the messes. P. 317, Q. 5551–5554. It would be a great advantage to the army were recruits required to learn to read and write before being discharged from drill. It is an evil that the soldier is not sufficiently trained to fatigue; there might be less drill and more work of a remunerative kind. P. 318, Q. 5557–5561. In the plains of India the men cannot, owing to the heat, take the exercise necessary to preserve health. P. 324, Q. 5637.

Dr. MOUAT—, states that the native troops are fond of gymnastic and athletic exercises. P. 332, Q. 5741–5742.

Serjeant-Major WALKER—, considers it would be an excellent plan to give the men the means of working at different trades, as at Aldershott, where they take a pleasure in doing carpenters' and masons' work, &c. Nothing tends so much in India to keep the soldier in health as to keep his mind employed. There are no separate grounds for games, which would be a very good thing. Gardens were attended to by several men who were gardeners, they being let off other duties. This was a great advantage, as good vegetables are the best things in India, but the gardens should be much larger. Sufficient gardeners would always be found, if relieved from other duties, and a few natives could do anything necessary in the middle of the day, and when the regiment moved an allowance would be made. The giving of premiums and public praise for the best gardens would be a great encouragement, P. 343, Q. 6041–6066.

Lieut.-Col. OUCHTERLONY—, proposes that oil gas should be used for lighting barracks made at each station from the common oil of the country and kitchen refuse, by which much better light would be obtained at less cost than is now incurred for lamps, which do not enable the men either to work or read with comfort.† P. 482.

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* The Kirkee Committee recommend singlestick as combining dragoon efficiency with amusement. (Appendix, p. 753.)

† The Kirkee Committee notice the want of sufficient light in barracks at night. (Appendix, p. 749.)

[N.B.—See notes pp. 201 and 202 *ante.*]

IX.—DISEASE AND MORTALITY.

DISEASE AND MORTALITY.

Sir R. MARTIN—, has seen great invasions of cholera and fever and dysentery, which are always most found in the worst stations as regards drainage, malaria, climate, bad ventilation, overcrowding, and filth. The correction of these evils would be the best preventive. Intemperance also is a cause, the prevalence of which in a regiment much depends on the character of the commander. Liver disease, liability to which increases with age, prevails almost everywhere and is often associated with dysentery, is much influenced by the circumstances enumerated, and personal hygiene. There is much rheumatism caused by sudden alternations of temperature, against which warm clothing is the safeguard. There is also mercurial rheumatism produced by cold while under the influence of mercury. Syphilis prevails to an enormous extent* (for which mercurial treatment is most detrimental, but it is still often resorted to. Q. 163, 164.) Police regulations are uncertain and various. Locks have been frequently established and again abolished. Scurvy has been seen in some high stations owing to defective diet and to climate, and guinea-worm prevails in Bombay; this is often referred to impure water. Pp. 4 and 5, Q. 94–128. Fever is by much the most prevalent disease, next bowel complaints and dysentery, after that affections of the liver and cholera. P. 8, Q. 213 and paper appended. The mortality among the British troops varies from 30 to 70 per 1,000. P. 16, Q. 267–269. The money loss during 30 years may be moderately computed at 10,000,000*l.* sterling.† The theory that acclimation renders men less liable to disease has been clearly disproved.

Colonel SWATMAN—, stated that the men suffer extensively from syphilis. Could not see how this was to be prevented unless by the re-establishment of locks, which he thought were discontinued as a measure of economy. P. 46, Q. 532–538.

Dr. DUNCAN STEWART—, does not think that acclimation confers any immunity from tropical disease. P. 50, Q. 615.

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* Dr. Macpherson points out the alarming extent of syphilitic disease. Addendum 12, par. 3, p. 34. On the last-mentioned subject strongly recommends legislative enactment, authorizing a system of licence and control in cantonments and sea-port towns, to be administered by commandant, senior medical officer, and senior magistrate of the district; that individuals, and houses open to inspection, should be licensed and registered; and Locks established. Such an experiment was made at Secunderabad in 1855, with almost magical success. Addendum 13, p. 34. See also results, p. 487.

† See Suggestions, p. 18; and Dr. Balfour's Observations, p. 20. See also Notes on Military Hygiene, by W. J. Van Someren, Madras Army. Epidemic disease is produced by a certain general condition of the body (*e.g.*, induced by bad air and water, nuisances, &c.) *plus* the specific poison of a particular disease. Instances several well known proofs in England, and points out the prevalence of epidemics at the Indian stations of Kurrachee (where the Rifles lost 76 per 1,000 in one epidemic in 1846); Bellary, Secunderabad, Vellore, Colaba, (the slaughter-house of more thousands of British troops than are destined to win fifty battles,) all mainly arising from overcrowding, bad drainage, and other local conditions. Produces proofs of injurious effects of over-fatigue in India; also intemperance. Gives a formula for production of disease, similar to the celebrated one by Dr. Bone for production of yellow fever in the West Indies. Addendum 10, p. 28. See further remarks on the Hill Fevers of Southern India, by Dr. Heyne. Fever is totally unknown on hills formed of quartz, felspar, and *real* horn-blende; on iron granite it is virulent. This he ascribes to magnetic or electric fluid disengaged in great quantity in the hot season. Recommends avoidance of hills as residence where magnetic iron sand is found, or within two miles of such. Addendum 14, p. 35.

[N.B.—See note p. 201 *ante.*]

DISEASE AND MORTALITY.

Mr. A. STEWART—, says separate hospitals for native followers are required; and Locks are much called for. These cases sometimes amount to one half those in hospital. P. 58, Q. 728.

Dr. McLENNAN—, had seen cholera prevailing among Hindoo soldiers and their families, whilst Mussulmans in the same battalion and lines entirely escaped attack. This was attributed to bad fish, from which the latter abstained. Had heard of several instances of epidemics attributed to the vicinity of nuisances, and one at Hyderabad from the use of stagnant water. Intemperance, night exposure, heat, cold, and moisture are predisposing causes. Cholera is most prevalent among Europeans in hot weather; among natives in cold. Diarrhœa and dysentery also are most prevalent at Bombay in the cold season, but generally in the hottest and wettest months. Dysentery often follows fever and is then most fatal. Sanitary measures of precaution and removal are usually resorted to on any epidemic outbreak; these are embodied in the regulations. Liver disease is very prevalent among European troops, also children and ladies; the natives also suffer more than is generally supposed from liver disorders. Should expect more from abstinence from liquor and avoidance of rich, stimulant, or full diet than from any other change. Rheumatism does not prevail much apart from maladministration of mercury for syphilis. Has seen scurvy from bad diet and exposure on the voyage out. It sometimes occurs among the natives from similar causes. Cause of guinea-worm remains in obscurity; probably introduced from without while bathing or walking in marshy ground. Is of opinion that climatic influence, intemperance, and sexual disease (from which latter a full fifth of the cases in the Bombay hospitals suffer) are the three chief evils affecting the health and life of the soldier in India (Pp. 89, 90, Q. 1221–1231). Thinks there is a gradual adaptation to the change of climate, but the man one year out is better able to bear exposure than those 10 years in the country. P. 93, Q. 1291–1293.

Dr. COLVIN SMITH—, states that the suppression of grog shops and the establishment of a Lock hospital at Secunderabad immensely improved the health of the troops in 1856. P. 99, Q. 1356. The native troops quartered close to a tank four miles long suffered much from fever, and guinea-worm produced by the water. Q. 1363. Had witnessed epidemic cholera in the Madras Rifles on the march, arising from fatigue and bad water, which ceased on the first rain. At Prome also, which is filthy, crowded, and surrounded with swamps in the wet season, had seen cholera among the native population. Considers intemperance, syphilis, and malaria the three chief causes of disease in India, all of which may be much diminished. Locks should be re-established, with good police. Had charge of a Lock at Hyderabad; and the commander of a European regiment observed, "Your hospital has diminished mine by at least one-third since its establishment."*

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* Dr. Macpherson observes, that 688 men of the home force are always in hospital from syphilitic disease alone, and that the money lost to the State is calculated at about 14,500*l.*, per annum. (Appendix p. 649.) The officers of the medical service are almost unanimous in recommending the establishment of locks. Dr. Grierson, however (Kurrachee), argues strongly against them on moral grounds, insisting on the expulsion of prostitutes as the proper remedy. (Appendix, p. 821.) Mr. Hare remarks that prostitutes in India are purchased and educated for the trade, and it is only necessary to punish those who profit by the women's earnings, to prevent the spread of disease. (Appendix, p.183–4.) The Umballa Committee are of opinion that locks might be aided by allowing the prostitutes to select one of their own number as their head; let her be well paid and made responsible that no diseased

[N.B.—See notes pp. 201 and 202 *ante.*]

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Thinks Locks were discontinued from false modesty, but has heard that there was an abuse of police authority which induced the Government, on the report of the Inspector-General of Bengal, to abolish these hospitals. Little could be done without the police; Pp. 102, 103, Q. 1502–1537. Men suffer from fever and inflammatory diseases for first few years, afterwards from chronic affections. Does not think they become acclimated. P. 105, Q. 1607–1609. Has seen erysipelas, but not gangrene in hospitals. Q. 1599-1601.

Major-General COTTON—, states that there is always more danger from cholera on the march than at stations. Has been much puzzled to find a reason for the outbreaks. Had found "Warburg's fever drops" invaluable. This medicine ought to be in every hospital and camp. Has known bad fever cured by it in a few hours. P. 129, Q. 2114–2123.

Mr. LONGMORE—, gives the mortality at Dumdum* from dysentery, fever, and cholera in five months during the mutiny at the rate of 27½ per cent. per annum among women, and 51½ among children. Pp. 131, 132, Q. 2172–2180. The latrines, &c. were very offensive. Q. 2219.

Dr. MACLEAN—, mentions that Secunderabad was remarkably exempt from cholera during 18 months that it prevailed at Hyderabad; it has since been more crowded, and the epidemic last year was severe. P. 139, Q. 2315. A malignant form of dysentery prevailed there. Q. 2339. The chief mortality in all stations is from dysentery, cholera, liver complaints, and fevers. Q. 2350–2352. The recent sanitary measures adopted by Sir C. Trevelyan at Fort George, Madras, resulted in no case of cholera having occurred among the troops in the fort during a severe epidemic in the town. Q. 2353. The enormous amount of syphilis and consequent loss of efficiency is becoming quite a state question. The ratio of cases to be treated is about 27 per cent. Locks, with the aid of the magistrates and proper supervision, would answer well. The native people are very obedient to authority. P. 143, Q. 2393–2406. Strongly recommends the introduction of an ambulance system for sick and wounded in India as a measure of economy as well as of relief. P. 145, Q. 2420.

Dr. M'COSH—, states that the debility produced by heat increases with the time of exposure. New comers generally do not feel the heat so much as old Indians. There is an absence of epidemics, cholera, smallpox, and fevers, &c. on the hills; but there is a disposition to diarrhœa, usually not dangerous, often beneficial, though in severe cases liable to run on to dysentery. Men going to the hills in a scorbutic state have suffered considerably from diarrhœa.† Scurvy prevails in Upper India from want of vegetables. Ascribes this hill diarrhœa —1, to reduced pressure of the atmosphere on the bowels; 2, the

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woman goes undetected. (Appendix, p. 235.) The Chunar Committee (Mr. Tweddell) recommend that the prostitutes, who are a distinct class in India and do not disguise their vocation, should be registered and numbered; and suggest that a small establishment consisting of a native doctor and two or three women, under the superintendence of the sanitary officer and magistrate, would be more suitable to native ideas than a regular lock hospital, and prove more effectual in reducing the amount of disease. (Appendix, p. 90.)

* See report of this outbreak, Addendum, note, p. 134.

† The Roorkee Committee believe that the hill diarrhœa is caused by water loaded with rotten vegetable matter. Mr. Hare has often prevented patients from drinking any but rain water collected in a tub, by stretching a sheet on four poles, and always with the result of stopping the diarrhœa. (Appendix, p. 183.)

[N.B.—See notes pp. 201 and 202 *ante.*]

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secretion of bile (the liver being affected) is lessened; 3, reduced perspiration induces extra internal secretion. The natives suffer largely from a disease called mahamurry, referred to their dirty habits. Pp. 148, 149, Q. 2512–2562. *Ennui* is the greatest evil the medical officer has to struggle with. The men rushing with indifference to their graves; he trying to prevent them. P. 152, Q. 2612. Men are never so healthy as when undergoing the fatigues of a long march. P. 154, Q. 2686.

Mr. JULIUS JEFFREYS—, estimates as very great the mortality arising from solar radiation (apoplexy) in India; believes that in particular instances it has amounted to 50 per cent. P. 186, Q. 2875–2886.

Colonel GREATHED—, states that the disease and mortality in the 8th regiment was small at first, and continued so during 15 years. They never had cholera except at Delhi. In the hottest station, Deesa, the mortality during three years was remarkably small. The men were accustomed to take active exercise. A man would walk 14 miles from the barrack, shooting, and be back at night; the well-conducted men always having unbounded liberty. P. 204, Q. 3201–3205. Does not believe in acclimatizing. After six or eight years' service a man is not so good as he was; but the deterioration mainly arises from a life of inaction. This would be improved by gymnasia. P. 209, Q. 3303–3308. Locks should be re-established; but it is a moot question with reference to the tyranny sure to be exercised by the police. Thinks the men are chiefly injured by the climate; yet it is not mere temperature. Pp. 209, 210, Q. 3316–3341.

Dr. BIRD—, states that in Bombay diarrhœa and cholera are the prevailing diseases in May and June; dysentery, gastro-enteric cases, with bronchitis, in June and July; and rheumatism, gastro-hepatic disease, and abscess, in August; and fevers from September to November. The ratio of mortality was from 40 to 55 per 1,000 (1847–1857); whilst at Poona and Kirkee it did not exceed 10 per 1,000, exclusive of reliefs from the low districts. At Belgaum it was 19. Pp. 213, 214, Q. 3418–3420. Does not consider the present army medical statistics of any value. They should be reconstructed and combined with meteorological and medical observations by intelligent medical officers. Conclusions as to healthiness of station can only be formed after residence of six or eight years. It would be better to trace the history of each regiment throughout. P. 216, Q. 3486–3506. Ascribes frequency of solar apoplexy to sudden exposure to the sun, often aggravated by spirits on the march. P. 220, Q. 3574–3583. Cholera is induced by miasmata, heat aided by bad sanitary conditions, improper food, vice, &c. Liver disease at Belgaum was chiefly caused by alternations of temperature; also rheumatism. Woollen clothing, bathing, and temperance are the best preventives. Scurvy is a blood disease analogous to rheumatism, arising from deficient nourishment and damp. Guinea-worm, produced by bad water, may be prevented by the use of filters. P. 220, Q. 3589–3596. Considers that the Europeans can be acclimated, so far as temperature, dryness, or humidity is concerned; but the human system, though it may resist, cannot become habituated to local endemic miasmata; the latter are removable by hygienic measures. It is as bad to transfer men too suddenly from a tropical to a temperate climate as the reverse. Such changes are better borne in youth than in mature age. Pp. 223–225, Q. 3650–3672.

Brigadier-General RUSSELL—, states that at Moulmein the men just landed from England suffered a good deal from dysentery, which was

[N.B.—See note p. 201 *ante.*]

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attributed to fresh pork and intemperance. P. 226, Q. 3691. Cholera at Fort George was attributed to an open drain close to the barrack-rooms. Q. 3700. Frequent removals to and from the hills would be rgarded with some dread, as a regiment seldom moves in Madras without an attack of cholera, generally attributed to bad water and over-fatigue. At Trichinopoly his regiment escaped, owing to precautionary measures taken whilst cholera raged in the bazaar and artillery barracks. P. 230, Q. 3795–3800. In calculating the mortality at stations, deaths among invalids who often die *en route* ought to be included ;—not being so, the mortality attributable to the station is generally understated. Accidents, however, are included, which are sometimes numerous. Mere heat, if equable, does not produce excessive mortality. In Rangoon, sickness was caused by insufficient food,—meat, fruit, and vegetables,—the country did not produce them. P. 232, Q. 3851–3860.

Sir P. CAUTLEY—, considers valuable a suggestion of Mr. Acton's,* that as a means of purification from syphilis, jets of water from cisterns, provided for the purpose, should be constantly running in all the barrack urinals, by which means local ablution could be frequently resorted to. P. 238, Q. 4010.

Colonel CAMPBELL—, has no complaint to make of vices among the soldiers in India. Syphilis is not common, not so much as at home. There is great power to check it. The native women frequenting the bazaars are known ; a list is kept by the bazaar-master, and if three or four men were found going in hospital, these women would be all examined by the surgeon, and those infected either cured or sent off. It is very easily done ; not at such a place as Calcutta perhaps, but at the stations generally. It is completely in the hands of the commanding officer. The sick are usually attended by the native servants, who are very good nurses. The conduct of the natives depends much on the way they are treated themselves. Has known a regiment entirely deserted by them. Considerable mortality took place among the 52nd regiment at Subathoo, caused by a four days' march to escape from barracks in a shaky state at Umballa, in the rainy season. The men were ankle deep, and the regiment lost 12 or 13 a month from fever and ague, for three or four months afterwards. P. 246,Q. 4212–4241.

Mr. ELLIOT—, recommends a scientific commission to investigate the circumstances under which malaria is generated, in order that better precautions against fever could be taken, *e.g.* in the selection of halting-places or sites for stations. An elevation of less than 5,000 feet can hardly be considered safe. Fever prevails chiefly at the foot of the hills. Thinks malaria is sometimes carried up ravines by the wind, so as to affect places in themselves free from it. Geological formation is thought to have an influence. Clearing the jungle appears to have been beneficial at Segoor. Any district once cultivated, and afterwards deserted, appears to be unhealthy, and to improve by being again brought under cultivation. The neighbourhood of rivers seems unfavourable. The wearing of gauze, muslin, or cotton appears to be a protection, as proved by Colonel Blake, in the deadly jungles of Rampa. Places long free from malaria may be suddenly deluged by it. Pp. 247–251, Q. 4242–4288.

Mr. MONTGOMERY MARTIN—, mentions decaying granite as producing malaria, *e.g.* at Hong Kong. Referring to Dr. Heyne, on the same subject, has understood that the limestone formation on the Indus has been productive of fever. P. 252, Q. 4291–4295. The Terrai, along the lower Himalayas, is covered with dank vegetation and forests, yielding at all times a pestiferous gas. There is no great unhealthiness in Tanjore from irrigation and rice cultivation. The fogs in Lower Bengal are noxious, to avoid which the mouth is often protected by muslin. They prevail near the ground, so that it is important that buildings should be well raised, as the upper stories are comparatively out of the fog. At Badulla and other places people may sleep on the ground without injury. Pp. 257, 258, Q. 4380–4406.

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* See Mr. Acton's observations recommending compulsory ablution and regimental locks, p. 489.

[N.B.—See note p. 201 *ante.*]

Mr. A. GRANT—, states that various sanitary improvements had reduced the mortality in the 12 years prior to 1854, 20 in 1,000, as compared with previous returns ; but that in the sultry and malarious plains the mortality must always be high. P. 260, Q. 4454–4456. At Fort William the mortality is now 69 in 1,000. Cawnpore is bad, and Allahabad worse. The strong men only should remain in the plains. P. 261, Q. 4464–4466. Five-sixths of the mortality arises from abdominal affections, induced by high moist temperature, intemperance, bad food, malaria, overcrowding. P. 262, Q. 4474–4483. The filthy state of ravines, insufficient ventilation, &c., at hill stations, were the causes of diarrhœa, &c. ; not cold or damp. P. 262, Q. 4484–4497. Thinks the mortality in India, now upwards of six per cent., might be reduced to four per cent. by proper sanitary arrangements at the present stations ; and to two per cent., if only stationed in good barracks, at such places as Rawul Pindi, Sealkote, Jullundur, Meerut, Agra, Hazareebaugh, Bangalore, Poona, and Belgaum, with depôts and reserves on the hills. P. 264, Q. 4539–4556.

Dr. SUTHERLAND—, considers that the zymotic diseases of India are the same as arise in England from want of drainage and ventilation, decaying animal and vegetable matter, bad water, and intemperance ; the atmospheric conditions appear to call these causes of disease into greater activity. The ample ration, with very limited exercise, is beyond doubt a cause of disease, and habitual tippling is more destructive to health in such a climate than occasional drunkenness.* P. 313, Q. 5494. The mortality may be greatly reduced even in the plains, in which every sanitary precaution should be carried out. P. 316, Q. 5526–5529.

Dr. FARR—, suggests that the system of recording and analyzing the diseases of the army in England should be extended to India, which would show the mortality in each regiment year by year, and thus test the salubrity of the different stations. P. 316, Q. 5532, 5533.

Sir A. TULLOCH—, states that the statistics of mortality in the army show a considerable excess in warm as compared with temperate climates ; but this ratio has been much reduced in the West Indies by sanitary improvement. P. 317, Q. 5534–5543. Doubts whether syphilis, though it undermines the health of the soldier to a considerable extent, is much more common among the military than civilians ; the ordinary proportion is about 120 cases per 1,000 men annually. The average mortality in India from 1817 to 1855 was 70 per 1,000

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* The Rawul Pindi Committee consider that to prevent hepatic disease, soldiers should not be allowed to consume so much animal food in hot climates. (Appendix, p. 256.) The Ahmednuggur Committee condemn health parades as needless and obnoxious. For neglect of immediate application men should have "with delay" marked against their names in the report book, and be obliged to make good all duties missed while in hospital. (Appendix, p. 840.)

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from all causes, including casualties in war. Since the mutiny, the ratio has been about half this mortality. Upon a strength of 70,000 men, the annual loss would be 4,200, which might probably be reduced to 1,400. The mortality among officers of the same average age as the men is about 25, and among civilians 20 per 1,000. The mortality among the troops need not exceed 20 per 1,000 if placed in healthy stations and other favourable circumstances. P. 318, Q. 5562–5596. Fever, dysentery, diarrhœa, and liver disease are the most fatal in tropical climates; syphilis also, which acts more indirectly by reducing the general health, and much increases the amount of invaliding. It has been proved in the West Indies especially that it was erroneous to suppose that men suffered greatly from want of acclimation. P. 324, Q. 5621–5642.

Dr. MOUAT—, states that the natives are liable to frightful outbreaks of cholera, fever, and dysentery. Has known 900 out of 1,000 men in hospital. Up country sepoys invariably become sick in the lower provinces. P. 331, Q. 5722–5723. The mortality among them is much higher than is apparent from the returns, as men if sick apply for leave, and die at home, when they are not included in the mortality register. The sepoy generally improves much at first after joining the service. Rheumatism, the sequelæ of fevers, and dysentery are the chief causes of invaliding. Among the Sikhs and Mahomedans there is much syphilis; the mortality would be double what appears in the returns, but that would be much under Europeans, as, being in their native climate, and more sober, they suffer less from injuries; inflammation runs a very mild course with them. The Hindoo buys no meat, the Mahomedans, Mughs, and Burmese do. Many of the natives are in capital physical condition. P. 332, Q. 5743–5775. In the prisons, the mortality is high, probably 12 per cent. last year. In damp malarious districts the village population is very unhealthy; but in the elevated districts there is a very fine population. They deteriorate exceedingly from change of climate. P. 333, Q. 5790–5800.

Dr. WALLICH—, states that the mortality among native troops greatly varies. Dysentery, fever, cholera, and rheumatism are the chief diseases. In some of the stations there is much syphilis, men are often sent away when past cure. There is no control over their diet or over their huts, so that there is no power of preventing disease. The men would not object to such proper supervision, if it were made a condition of their employment. Few of them drink. The worst evils are impure water, bad drainage, and ventilation. Would recommend weekly inspection, and the use of prophylactics and gentle medical treatment without sending them into hospital or taking them from duty. They should be encouraged to apply to the medical officer for this purpose, when slightly affected or out of sorts. P. 336, Q. 5861–5922.

Serjeant-Major WALKER—, states that more men are invalided and killed by syphilis than any other disease except fever. It might be diminished by vigilant superintendence of the women by native doctors in native hospitals; those diseased being sent away. The orders of Government are good and well intentioned, but not properly carried out by subordinates. Considers much disease is caused by bad drainage in barracks, and filth in the neighbouring towns, *e.g.* cholera, fever, dysentery;—but the men prefer India to other stations after experience of the service. Fresh troops stand the climate better than old soldiers, but the latter cannot bear the cold in England. P. 345, Q. 6089–6128.

[N.B.—See note p. 201 *ante.*]

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The sick are attended by natives and regimental orderlies ; there is no ground of complaint. P. 346, Q. 6141–6145.

Mr. JULIUS JEFFREYS—, urges the use of the respirator for weak persons going to the hills. He further recommends the use of external compression of the limbs in cholera ; also the use of aromatic oil applied to the skin as a protection during epidemics. P. 499.

Dr. DEMPSTER—, considers that troops are most liable to disease during the first two years in India, *e.g.*, dysentery, hepatitis, remittent fever, and sunstroke. They are afterwards less obnoxious to these diseases. Cholera is exceptional ; no rule can apply. A detachment of 300 men landed in the cold season in 1853, and marched straight to Meerut ; all had a slight attack of fever in the ensuing hot season, but none died. It is an advantage to recruits to join old Indian soldiers who understand precautions. After 10 years' residence the constitution deteriorates and becomes liable to chronic liver disease, &c. among the men, though the officer will then be at his best. P. 475. Points out the necessity of frequent examinations both of women and men to guard against syphilitic disease, also the enforcement of frequent ablution on the part of the latter, especially after contact. P. 467.

Dr. EATWELL—, observes that in the absence of a correct census there is great difficulty in estimating the mortality among the natives of India. The only means are the records of the places of interment. Dispensaries, native, and gaol hospital returns may furnish a tolerably correct idea as to the prevalent diseases. Also returns of native regiments, though these have often serious sources of error, recruits being frequently predisposed to disease. P. 480.

X.—MORAL CONDITION OF THE SOLDIER.

SOLDIERS' MORAL CONDITION.

Lieut.-Colonel GALL—, states that the soldier cannot marry without consent of his commanding officer, or if he does his wife will not receive the usual allowance of five rupees a month. About 12 per cent. of married men are allowed to live in barracks. There are not many marriages without leave. Native women receive half the allowance given to Europeans. They require fewer comforts indispensable to Europeans. Some of them are well conducted. They seldom leave the country. Generally the man would volunteer into another regiment on his own leaving for England. P. 80, Q. 1001–1012.

Dr. MACLEAN—, considers that if marriage were encouraged among the soldiers, and they were located on the hills, they would be much better, healthier, and happier in every way than they are now. They would require assistance from the Government, and it is a financial question of considerable importance. P. 144. Q. 2407–2414.

Dr. MCCOSH—, states that artillerymen are generally better selected, and they are more careful, steady, studious, and active than soldiers of the line ; they look forward to promotion, and they suffer much less from ill-health in consequence of their better habits. Pp. 150, 151, Q. 2567–2581. Good results might follow from instructing the men, especially recruits, as to care of their health ; a short manual should be placed in their hands. The soldier should have more inducement to live. Having no motive for the future they regard life very little. They should have the means of living when discharged. They should be employed in public offices and works, &c. The average pension of 29,000 men is 8¼*d.* a day. The soldier should have light employment or a better pension insured to him, as after 10 or 20 years in India he

[N.B.—See note p. 201 *ante.*]

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returns a broken-down man. Pp. 151, 152, Q. 2597–2620; p. 154, Q. 2684–2686.

Sir JOHN LAWRENCE—, believes the more inducements held out to the men the more likely they are to behave well; he would, therefore, advocate increased pensions. P. 192, Q. 2958–2959. Moral influences should be brought to bear on the soldier to induce him to look more to the future. Marriage should be allowed, which makes them more steady, careful, and manageable. Their pay should be increased to help them. The wives keep them straight. The soldier's wife also should be taken care of and allowed to go with the regiment. The desertion of his wife demoralizes the man. The women should be carefully looked after in cantonments, by a picked officer, when the men are in the field. Widows also should be taken care of, the want of such care shortly forces them into unsuitable marriages or worse. Tickets may be left with the paymaster to secure remittances to families. The men should be made as contented as possible, which would make a great difference in their feelings and fidelity. The practice of abandoning the wives when a regiment goes on service produces terrible results. Pp. 199, 200, Q. 3063–3070.

Col. GREATHED—, states that the moral tone of the men in India is much higher than it is in England. There are no pothouses there. Though there may be much vice, yet the native bazaars do not afford them society in which they live. P. 200, Q. 3082–3084. Has frequently known a fortnight to elapse without one man out of 1,000 (the 8th regiment) being confined for drunkenness. P. 203, Q. 3160. The unbounded liberty given to the good men was never abused; it was quite a point of honour with them to behave well, and there were never any disputes between them and the natives. P. 205, Q. 3208, 3209. It would be a great advantage to have more married men, say 25 per cent., they are more free from crime. If the women were better cared for when the men take the field, much might be done to remedy the present evil; but not unless better arrangements be made for the maintenance of the wives. There is a difficulty when the regiment comes home, for the married men do not volunteer in the same proportion as the unmarried, though admitting they are better off than in England. It arises probably from the loss of their children.

Brig.-Gen. RUSSELL—, considers that the married men quartered in separate huts are better behaved, respectable, and contented. They are more healthy. Would allow 25 per cent. to marry, but the number would seldom be kept up. A man should have at least 50 rupees to start with. The drain on the canteen fund is heavy for the families when the regiment is away on service. It happened more than once that married men, from regiments ordered home volunteered into the 84th regiment, which happened to be stationed near, because of the small expense of moving their things. P. 228, Q. 3748–3765. The soldier should be treated with consideration that he may imbibe self-respect and control. Men are very much what they know your opinion of them to be. P. 230, Q. 3789.

Colonel CAMPBELL—, considers there is a general improvement in the conduct of the soldier of late years, produced by improved discipline, the good conduct warrant, amusements, and encouragement in many ways. P. 243, Q. 4109–4112. The conduct of the 52nd regiment in India was admirable. Q. 4103. Has no complaint to make at all about the vices of the soldier; it would be impossible to get 1,000 men to behave better. P. 246, Q. 4212.

[N.B.—See note p. 201 *ante.*]

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Colonel DURAND—, is of opinion that a larger number of men might be allowed to marry, which makes them healthier and happier; but there are great difficulties in regard to the care of the women, and to the service regulations elsewhere. P. 286, Q. 5137–5140.

Sir C. TREVELYAN—, considers that motives for improving their condition in life should be offered to the soldiers to induce them to exertion, such as the prospect of employment in the police and public works, commissariat, ordnance, and other departments; we should thus improve our administrative system, leaven the mass of the population, benefit the men, and so raise the character of the service as to encourage recruiting. This would encourage a kind of colonization eminently applicable to India. With these views, he had established stipendiary studentships for soldiers at the Civil Engineering College at Madras. Men recommended for good conduct, and having some elementary attainments, were allowed to compete for these, but the number of applicants was so great that a preliminary regimental examination was found necessary to decide upon the candidates; and thus 20 picked men were collected for the administrative service. This system might be extended, the men being separated from the army at the end of a fixed probationary period. Such inducements being held out would not only tend to keep the men out of mischief, but to prevent the *ennui* from which their health suffers more than from actual disease. P. 299, Q. 5357–5361.

Sir A. TULLOCH—, is of opinion that in unhealthy stations the spirits of the men break down, and they are often driven to dissipation in consequence. P. 324, Q. 5635.

Dr. MOUAT—, describes the bond of caste among the Hindoos as much loosened; high-caste men will often perform the most menial duties for European officers who treat them kindly. Much of their time is spent in idleness. There is generally little to complain of on the score of temperance among the sepoys, but the Sikhs are fond of drink. P. 331, Q. 5734–5740. Does not think it possible to improve the condition of the sepoy; and they have every advantage and indulgence. They become much attached to those officers who treat them kindly. P. 334, Q. 5806–5811.

Serjeant-Major WALKER—, states that it is difficult to get women fit for soldiers' wives. The married men are much more comfortable in India, and far better off with detached quarters. If the wife be careful he may save money. When on active service the women are left at the depôt. The married men are steadier, not so often in hospital, and less liable to many diseases, and more contented than the single men. If on the hills, more men might be allowed to marry, but on the plains the children dwindle away. P. 344, Q. 6067-6087.

XI.—STATIONS ON THE HILLS.

HILL STATIONS.

Sir R. MARTIN—, considers that altogether heat, with malaria, constitutes the most powerful source of disease in India. Proper sanitary arrangements would effect much improvement, but the periodical removal to mountain stations is also of great importance—a State necessity.* These should not be on the front spurs, which are always wet, but some 40 miles to the rear, where it is comparatively dry—*e.g.*, at Chenee as compared with Simla, where this has been overlooked. In Sylhet and Assam the same oversight has occurred. Believes there are table lands to be found having pasturage, water, shade, and means of cultivation suitable even for cavalry and artillery. The present hill stations are often too high as well as too wet, and injury has often been caused by sudden removal from a dry heat, to cold and damp. The mountain ranges should be used as preservative of health; they are not curative. If troops on arrival were sent to the hills they would be maintained in health and vigour, descending annually to the plains in the cold season for military exercises, and whenever the state of the country required their presence; but no man should stay longer than 12 months at one time in the plains. Of British children residing in the plains of India one in five only survive the fifth year, while in the mountains they thrive as at home. The theory that acclimation renders men less liable to disease has been clearly disproved. Hill stations could be better protected by medical police against intemperance, syphilitic diseases, &c. Pp. 5, 6, Q. 129–163. Thinks that in cantonments in the hills the same immunity from disease might be experienced as in the mountains of Jamaica. P. 8, Q. 201. Sick-leave would also be greatly avoided, and much cost of buildings for treatment of disease saved. Q. 211, 212. (*See also* Notes on Mountain Climates, p. 11.) The best elevation has yet to be determined; the lower ranges, of from 2,000 to 4,000 feet, have been hitherto neglected. Refers to recently discovered table-land at 3,000 feet near Calcutta. 2,500 feet would probably be above the fever range.* Solitary mountains are preferable

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* Inspector-general Pearse considers the intermediate climate of Bangalore more suitable for newly arrived Europeans than any hill station, and would recommend the establishment of a large depôt there accordingly. (Appendix, p. 609.) Believes the

[N.B.—See notes pp. 201 and 202 *ante.*]

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location of Europeans on the hills (independent of the army) would be productive of the happiest results on the native mind, and afford the means of recruiting. (Id. P. 615.)

* See Dr. McLelland's paper, p. 17; also Suggestions, p. 19, pars. 11–18, and p. 20; and Observations on Myrung, p. 23.

Dr. Brodrich, Assistant-Surgeon, Madras Army, reports that Goonah in Malwah on the trunk-road, about half way between Indore and Gwalior, on elevated table-land, more than 2,000 feet above the sea, has been remarkably free from cholera, and troops stationed there have enjoyed excellent health. The rains are not very copious; the heat never extreme; hot winds unfrequent, and with little dust. In the cold season the climate is unexceptionable; invalids rapidly recover. There is much syphilitic disease. Thinks this might be got rid of by medical police. Dysentery rare; rheumatism less prevalent than at other stations. Country undulating, with large grass prairies, well watered. Wheat grown largely. Excellent breeding station for horses, and therefore for large body of cavalry. Sipree, on same formation, about 60 miles distant, would be equally well adapted for infantry. Addendum, 9, p. 24.

See Opinion of Surgeon J. W. Fletcher as to healthiness of Morflong. At the top of the Cossiah range of hills, between Assam and Sylhet, the table-land is about 40 miles wide. Morflong, about mid-way, has 5,800 feet elevation. Soil rocky and gravelly; surface undulating. There is a great extent of land suitable for buildings, recreation, and military evolutions. Thinks it well adapted, on sanitary grounds, for a station. Scarcely a day in the rainy season during which the men could not get out for exercise. Addendum 11, p. 33.

Also Letter from Dr. Macpherson, pointing out the desirability of various salubrious hill ranges. Troops at Cannanore should be placed on the Neilgherries, at Trichinopoly on the Pulnegs, having a plateau of 15 miles by 30, with abundant water. The Shinags, 5,000 feet high, within a night's run of Madras by rail, where all recruits from England might be placed. Near Vizagapatam, not far from Bellary, also midway between Nagpore and Hoosingabad, are mountain ranges. Addendum 12, p. 33.

Dr. Pinkerton reports that Nynee Täl has an elevation of 6,400 feet, and is situated in a glen, with a lake or täl in its centre. All the barrack and hospital accommodation is as bad as well can be; ill drained and damp, no latrines, every kind of surface filth. All these drawbacks should be remedied. The climate, during

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when they can be found, as Aboo; and by so placing our troops the idea of Hyder Ali, of keeping our Europeans in cages, ready to let slip, would be realized. It is the general native belief, according to Sir Mark Cubbon, that until these heights are occupied our possession of the country is insecure. Believes such elevated stations may be found in every province, but none such should be permanently occupied until tested first by natives and then by Europeans in huts. Drill may also be advantageously carried on at such high stations. The subject of sites and elevation has to be investigated *ab initio*. Pp. 15, 16, Q. 241–270.

Colonel SWATMAN—, believed that the hill stations at present existing are very confined, so that the men do not appear to enjoy themselves. P. 46, Q. 502–510. Considered acclimation beneficial as a preparation for future service, but many men are lost in the process. Officers are more careful, and occupy better quarters; they have also furloughs of two years after ten years' service, they therefore suffer less than the men. If there were space enough and occupation at the hill stations it would be very advantageous to station the men there. Was not aware of any plan having been adopted for investigating the mountain climates. P. 47, Q. 550–572.

Mr. A. STEWART—, thinks it would be very desirable to station the troops on the hills as far as it can be carried out. P. 61, Q. 781–783.

Lieutenant-Colonel GALL—, considers that it would be advantageous to station the troops on the high lands if it could be accomplished. Railways will facilitate transport. European troops quartered on the lower range of the north-western Himaleh would hold India securely, and be prepared to meet invasion from the north-west, and defend the line of the Upper Indus. Military colonies might be established here. Marriage encouraged, and inducements held out to settle. Children born in these regions grow up healthy and strong. Believes Europeans generally would be as healthy there as in Europe. Troops are generally kept five years at a station; sometimes three, or even two in Sinde, which is very hot and unhealthy, except Kurrachee, which is healthy, being on the sea coast, and visited by the south-west monsoon. Believes there would be fewer applications for leave were the troops stationed in the hills. Expenses of officers on sick leave are paid by Government. P. 80, Q. 987–1000.

Captain J. E. T. NICOLLS—, describes the hill stations as all situated on the ridge or spur of a hill. P. 81, Q. 1024. These stations are decidedly favourable for the preservation of European health; situations in the rear would be far preferable as being less exposed to the monsoon. Thinks police regulations may be better enforced than in the plains, but that natives would not be kept out by want of roads, as they would resort to bye-paths if they desired to get at the station. Temporary huts might be used whilst such situations were being tested. Supplies would chiefly have to be carried up from the plains at considerable expense, and roads constructed of great length. The soldiers would

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eight months, is clear, bracing, and invigorating; 219 days generally fine, 68 clouded, and 78 rain, hail, or snow. Average rain-fall 112 inches. Temperature at dawn, 51; noon, 64. There is no diarrhœa or cholera. During the four bad months hepatic complaints, rheumatism, head affections, and intermittent fever are common. But though invalids gain nothing in the damp season they lose nothing, and recover rapidly afterwards. Invalids sent here should be selected with reference to their disease, and proper accommodation provided. Of 599 sick sent thither in 1858–9, 136 were invalided and 19 died. Addendum 15, p. 37.

See Descriptions of Ottley Pett, and Ramandroog, Addenda 16 and 17, pp. 38–9.

[N.B.—See note p. 201 *ante*.]

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be by so much removed from the scene of action. The hills are not liked from want of space for moving about, and less freedom for intemperance and debauchery. Vegetables could be cultivated; cattle might also be raised, the herbage being good. Pp. 83, 84, Q. 1108–1151.

Dr. McLELLAN—, does not think that any great advantage would be gained in point of health by stationing the soldiers on the hills, except for better police. The general presence of invalids on their way home increases the mortality at Bombay, nevertheless the policy of removing troops from low stations to mountains within a moderate distance is advantageous; is quite recognized in Bombay, as at Poona, where supplies are easily obtained, and will be more so on completion of the railway; but there are deadly fevers in the Deccan; at Poona even there is fever and cholera. At Aboo the monsoon is heavy, being in the front. Inland from the Ghauts it becomes much drier. Pp. 90–92, Q. 1232–1281.

Dr. COLVIN SMITH—, is of opinion that the stations are sometimes too high, especially in Bengal, *e.g.*, Sinchul, on a spur where it always rains or snows; there are medium ranges available both in Madras and Bombay. Ramandroog in Mysore, at 3,000 feet, is very healthy. Had seen invalids at Darjeeling soon become robust and strong; others suffering from dysentery, chronic disease, and phthisis, were made worse by the cold and damp. Stations in the mountain ranges are the most healthy, and should be greatly increased in number to maintain the troops in ordinary health. There would be a great saving in the long run by preserving men's lives and prevention of sickness. Considers men previously living in the plains more capable of bearing the heat than those fresh from the hills, though the troops from Simla were remarkably healthy before Delhi, with the exception of cholera. They should not remain in the hills during the cold season, but descend to the plains for drill, &c., for which there is not room, *e.g.*, at Darjeeling. Believes there is no want of good and extensive positions in India on high lands; there has been no systematic inquiry. There should also be coast stations. Pp. 103, 104, Q. 1543–1580.

Major-General GOODWYN—, considers that it would be advantageous to place more troops at hill stations, reducing the number in the plains, *e.g.*, at Jullundur, Umballa, Delhi, and Meerut. With rapid means of communication there would be no difference in a political aspect. The late Major Abercrombie agreed in this opinion. Building might be more expensive on the hills, as carriage would be greater, but does not know the rate of labour there. Pp. 111, 112, Q. 1789–1804.

Major-General COTTON—, believes the Neilgherries will be found the best home for Europeans in all India; not being precipitous, but everywhere level and habitable, roads can be opened with facility. Jackatalla is out of the rainy portion of the district, and troops are stationed there all the year round; the men first stationed there, though very confined in temporary thatched mud barracks, were remarkably healthy, and none died except amongst those who came up invalids. Pp. 124, 125, Q. 2014–2025. The distance from the plains to the south is 20 miles, to the north 40, to the west 70. Good roads have to be made. There is unhealthy jungle intervening from 20 to 30 miles wide on all sides. Does not think the cost of maintenance will be greater, when things are settled, than in the plains. Provisions can be obtained on the spot, and there is a large extent of country capable of cultivation. Temporary buildings and huts should be used for

[N.B.—See note p. 201 *ante.*]

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testing a new climate, but this is not required in the Neilgherries. Pp. 124, 125, Q. 2017-2037; also P. 128, Q. 2024–2029. Inquiries should be made wherever hills can be found. Europeans should be placed there (first in huts) if troops are required in the neighbourhood. There is hardly a province without hills within two or three days march from any existing station, *e.g.*, Mysore, Travancore, the Deccan, &c. Thinks malaria is often very local, probably confined by trees, as in a tank, or the form of the ground where there is no outlet. A new hill site should always be tested by Europeans, a few would suffice. The health of the natives is no certain guide. Any elevation of 6,000 feet might boldly be tried, or even to 2,500 feet. Mischief sometimes follows the first turning up the ground; a site should not, therefore, always be hastily condemned on a first failure; local knowledge is the only guide. A good opinion may be formed as to the probable healthiness of a site. Pp. 126, 127, Q. 2055–2086.

Dr. MACLEAN—, is of opinion that it is possible to remove most of the plain stations to neighbouring hills, *e.g.*, the Neilgherries; Beda, 2,000, and Ramandroog, 3,500 feet, near Secunderabad, and two or three days from Hyderabad. Bangalore, 3,000 feet, is a healthy station; the men enjoy themselves there, as at Poona. The Neilgherries are a day and a half from Trichinopoly, and are available also for Cannanore, going by sea to Naguputum; the Animallay hills also. Troops concentrated on the Neilgherries might act in any direction, so that very small garrisons need be left in a few important forts, such as Madras. One season is not a sufficient test. Pp. 137, 139, Q. 2239–2305. Booldana has not been used for troops, but people are remarkably healthy there. Q. 2323. Chindwarra is four or five days from Nagpore, where the heat is excessive. The Bombay railway will pass by Nagpore. Both Jackatalla and Trimulgherry were at first unhealthy, from the neglect and filth of large bodies of workmen during the erection of the buildings; this should be better regulated. P. 140, Q. 2321–2337. The hills will not restore health, the sea coast must often be resorted to, *e.g.*, Waltair; severe cases must go to sea. P. 142, Q. 2356-2363. The cost of maintenance may be greater on the hills, but the saving of life will much more than repay it. Q. 2372.

Dr. MCCOSH—, believes that at Almorah (5,600 feet), Kumaon, in the Himalayas, 10,000 men might be comfortably cantoned, and very perfect sites might be found on the Deo Dhoora range, 6,000 or 7,000 feet. Also at Lohooghaut, 5,500 feet. Thinks the latter the best elevation. Most of the hill stations are too high. During the cold season troops might encamp on the Terrai, which is then healthy, for exercise, and be employed in clearing the jungle, so as to make its passage safe at all seasons. A railway to the foot of the hills from Kanouge would place the troops in one day on the Ganges, but with a proper amount of clearing he should not apprehend danger from marching from Bareilly to Almorah. It is very desirable that the troops should be quartered in the hills; it would be very conducive to their effective strength. During the mutiny, the men fresh from the hills went through the campaign at Delhi better than those from the plains. Pp. 148, 149, Q. 2488–2528.* The hills generally are more valuable for prevention than cure, and consumptive, dysenteric, liver, and rheumatic patients should not be sent thither. Yet under most diseases men benefit largely by the change; or when suffering from *ennui*,—as a preparation for service. P. 150, Q. 2553–2556.

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* See also P. 153, Q. 2635–2642.

[N.B.—See note p. 201 *ante.*]

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Mr. Julius Jeffreys—, is of opinion that permanent quarters for troops should not be higher than 4,000 or 5,000 feet, and that, therefore, there should be stations at two different elevations, some being at 7,000 or 8,000 feet for persons suffering from particular forms of disease. The heavy rains would be avoided by going further into the hills. P. 187, Q. 2887–2892.

Sir John Lawrence—, has no doubt the men would be healthier in the hills, though it does not agree with some constitutions; but there would be difficulty for financial, as well as military and political, reasons. The bulk of the troops should occupy the best strategical positions. One regiment will hold a country which would require ten to recover it if lost; it was so in the mutiny; had more troops been stationed at Delhi and Cawnpore, those places would not have been lost. Each cantonment should be held in sufficient strength to be able to assume the offensive at any time, if ready to do so the occasion may never arise. The Europeans are few and at a long distance from their resources. In times of danger there is a kind of panic apt to create confusion, increasing the difficulty of bringing up reinforcements. The native chiefs have considerable power, though it is much exaggerated. Railways would modify these circumstances, but does not believe they will enable us to leave the plains unprotected. The weakly and delicate men should be sent to the hills every year, and the robust kept below; thus 300 out of 1,000 might be in the hills, and form a reserve in emergency. In Madras the natives are more gentle, so that there is less occasion for holding strategical positions, and these also are nearer the healthy stations. It is different in the north,—*e.g.*, Agra, itself a capital, watches the whole of the Gwalior district; the best arrangement there is for all the regiments to be in the plains, having 200 or 300 men from each in the hills, which should be thus used as sanitaria. The natives about Peshawur, for instance, are very observant, and the whole valley might be lost in twenty-four hours. It is not possible to foresee when and how danger may arise. It is a question of numbers; with 80,000 men, 20,000 might be in the hills; with 70,000, 10,000. In the event of an outbreak railways may be broken up. The troops must be on the spot to overawe and prevent disaffection. Disarming the population can only be effected to a very limited extent. It requires great management. There are greater difficulties on all these questions than people can conceive. The troops should be chiefly placed where the natives are most warlike. Except at Calcutta, many are not required in Bengal. 5,000 in Bengal would go further than 10,000 in the upper provinces, where some of the stations are, perhaps, as healthy as the hills. In Madras and Bombay there is no difficulty in making hill stations available, but it would not be possible to place the majority of the troops on the hills in Upper India. Having open field works might enable us to economise the force to some extent. P. 193–196, Q. 2963–3000. Children thrive well in the hills. Thinks the mortality is less than in England, whereas in the plains they die at a fearful rate. They all wither and die, chiefly after five or six years old. Q. 3072, 3073. The women also suffer immensely. At the Lawrence Asylum, and similar institutions on the hills, the children all flourish, they run about all day. The fathers do not get on so well because the stations are confined, and there is great difficulty and fatigue in communication with neighbouring places, therefore they do not get enough exercise. This would not apply to extensive table-lands. P. 198, Q. 3042–3062.

[N.B.—See note p. 201 *ante.*]

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Colonel GREATHED—, thinks the mortality among regiments quartered in the hills is not less than those on good plain stations; no doubt the hill-men look much better. Where there is no table-land, *e.g.*, Mussourie, there is great difficulty in carrying out sanitary arrangements, and filth lies in all directions; when the rain falls it is intolerable. The only hill station he had seen where the men were perfectly healthy was on a table-land at Mahableshwur, but they cannot be kept there during the rains; it catches the south-west monsoon. There is also a difficulty in the want of ground for drill. This does not apply to the Neilgherries. P. 207, Q. 3261–3272. Considers it of the first importance to keep bodies of troops at the main strategical points. It would be a great thing to have the men in the hills, could it be done with equal advantage, politically considered. By railways they might be quickly brought down, but the plains should not be neglected. P. 210, Q. 3341–3351.

Dr. BIRD—, found the climate of Mahableshwur at 4,500 feet less beneficial to sick than had been expected, especially in affections of the lungs and bowels. It is cold and temperate; residents were in good health, but suffer more on transference to the plains. The air is rarefied and light, unpleasantly dry in fair weather, and surcharged with moisture in the rainy season. P. 213, Q. 3421–3425. Considers table-lands of 2,000 feet, exposed to the sea-breeze and protected from dry land winds, the most healthy, and are far preferable to hill stations. Diminution of atmospheric pressure counteracts the invigorating effects of higher ranges. The confined space in some of the hill stations is a great drawback. Greater elevations from 3,000 to 8,000 feet may be advantageously used for change of air for debilitated men from the upland plains. Places open to the ocean breezes with no great rain-fall, as the Neilgherries and Newera Ellia in Ceylon, might be found advantageous for the residence of troops. Would use such places as Mahableshwur as prophylactic stations during the hot months, and in that way all the benefit may be had that can be obtained from hill stations. The hill climates have been more beneficial to children than adults. Danger at high elevations is caused by underrating the power of the sun, and consequent exposure. People while on the hills will be more healthy than in the plains, but suffer more in again descending. There is acclimation to temperature, but men quartered in hot malarious plains would suffer more in a campaign than men from the hills under the same circumstances. P. 221–223, Q. 3597–3648.

Brig.-Gen. RUSSELL—, is of opinion that the withdrawal of the troops from the plains would render a larger force necessary. The sheathed sword must always be in view of the natives. Probably 100 men in each regiment would suffer from the change. P. 230, Q. 3791. Considers that 800 men on the principal road or near a large station would have more effect on the native mind than 2,000 upon the hills, and soldiers are unproductive labourers. In case of disturbance the men would suffer in coming down by forced marches. Stations have been selected at too great an altitude; for six months the men are living in the clouds. P. 230, Q. 3801–3809. The danger during the mutiny arose from the native troops rather than the population. The health of the army is most important; would place the troops where they would be likely to enjoy the best health, provided the security of the country was not sacrificed. P. 232, Q. 3867–3879.

[N.B.—See note p. 201 *ante.*]

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Sir P. CAUTLEY—, states that at Landour, which is very elevated, there are many ravines and hollows, into which refuse and filth is thrown, so as to be extremely offensive. To this cause may probably be ascribed much of the diarrhœa which prevails at these hill stations, often attributed to the water. P. 235, Q. 3941–3946. Considers that troops are sent to India to be usefully employed, but if they are too much out of the way, in the Himalayas, they would be of no use. Elevated plateaux, easily accessible and escaped from, are very different. There are such elevated spots, but covered with jungle, and the difficulty would be how to test them. Probably the plan would be to send up natives to clear, dig, plant, and fence in a spot, and then leave it for a time, and send up again at intervals. A new station cannot be fairly tried in one year; Harris' valley in the Gallicondah range, Madras, was too hastily abandoned. Pp. 237, 238, Q. 3993–4009.

Colonel CAMPBELL—, would say that a regiment should go to the hills first rather than afterwards, and be brought gradually into the plains. They are better for preserving than restoring health; but it is beneficial to send certain invalids thither as a sanitarium. In Cashmere, about 30 miles from Sealkote, Dr. Graham and others had visited a beautiful plain 16 miles in circumference, with good water, and a temperate climate, calculated for any number of troops; there is not generally sufficient space for troops. If stationed in the hills they should be brought down for exercise in the cold season, and to show themselves. It would not be safe to leave the great cities without garrisons. Railways might make a difference. Has no doubt from the number of troops in India that a great reduction might be made in plain stations without abandoning really important posts. They could be better kept in bodies not too large, as reserves. P. 244, Q. 4150–4166.

Mr. ELLIOT—, thinks there would not be the slightest difficulty in Madras in administering the police of the country, so that a considerable portion of the troops might be quartered in the hills, leaving comparatively small garrisons at the plain stations. The principle has been largely acted on by withdrawing the whole military force from all the provinces, except three or four principal stations, and with the best results. Is convinced that the natives are intelligent enough to understand our power, and to be aware of its existence, though they may never see a soldier. There is ample room on the Neilgherries, also on the Mahableshwur range. Such stations should be used, both for recruits on arrival and for sick in a majority of cases. Pp. 248, 249. Q. 4269–4286.

Mr. MONTGOMERY MARTIN—, considers it advisable to place the troops above the rain gauge limit, which varies in different parts of India from 3,000 to 4,000 feet; moisture being most inimical to health, whether conjoined to heat or cold. Badalla in the interior of Ceylon is a valuable spot for the preservation of European health, and in a strategical view well calculated for the concentration of troops to be moved on any part of the Indian coast. Elevations near the sea have a great advantage. Considers Mussora Point near Kurrachee very eligible. Calcutta is highly insalubrious, and the seat of Government must sooner or later be placed higher up. In Bengal the Rajmahal hills are accessible. There is a healthy region in Bundelcund. About Malwah the rajpoots, as a race, have maintained their vigour. In the Deccan the people are more vigorous than in the valley of the Ganges. P. 252, Q. 4296–4379.

[N.B.—See note p. 201 *ante.*]

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Mr. A. GRANT—, states that there is nothing which would render it inexpedient to station a large body of troops on the Neilgherries. The locality is very accessible; there is plenty of room, open to the sea-breezes, and by moving from one side to the other the rains may be altogether escaped. All patients are benefited there, except those suffering from affections of the heart and brain. Has not seen any diarrhœa there, nor scurvy; vegetables and water are good and abundant. European labourers might be employed there without injury, and with their families might occupy that country. Would not recommend Newera Ellia, Ceylon, as a station for troops; it is far inferior to the Neilgherries, and very expensive. Every regiment should have a convalescent depôt on the hills, to which the weakly men and officers may be sent, who would soon be set up and ready as a reserve. There might be the regimental records, workshops, gardens, &c., and recruits might be sent thither and drilled. One-third or half the whole force might be in the hills. Pp. 259-261, Q. 4407–4469. Considers the hills of great importance for the cure of disease, as well as the preservation of health. New stations at first unhealthy have proved healthy afterwards; *e.g.*, Pegu. Cholera has not been known at Darjeeling or Nynee Täl. Pp. 262, 263, Q. 4498–4521.

Colonel DURAND—, thinks it would endanger the security of the country to place large bodies of troops permanently in the hills, but that the depôt system spoken of by Mr. Grant would be exceedingly useful. Any surplusage or reserves beyond what are necessary for the quiet occupation of the country may be stationed in the hills, especially when the railroads are completed; but the key-points, *e.g.*, Allahabad, must not be given up, the country being held practically by the sword, and small posts should be avoided. It is not possible to keep the population disarmed. P. 285, Q. 5122–5136.

Sir C. TREVELYAN—, considers that the plain stations must be held, and troops occupying these stations are in some degree acclimated and better able to act effectively than they would be if suddenly brought down into the plains. In the hills the men complain of want of society and amusement, and of a market for their labour, if disposed to work; they are therefore more difficult to manage, and are better both for their own sakes and the public service in the plains. All efforts should be brought to bear on the conditions of health there. Would recommend that the Wellington barracks be made a sanitarium for the south of India for weakly men wanting change of air in time to prevent sickness, and they should have the same freedom to resort to the sanitarium as officers have. Strong men prefer being in the plains. The railways will facilitate transport to the sanitarium; they will also enable smaller garrisons to be kept at the present stations by the concentration of a large force at healthy stations within easy reach, *e.g.* at Bangalore, which commands the whole of Southern India. Believes small posts, *e.g.* Vellore, to be a source of weakness, and for this reason had removed detachments from Dindigul and Masulipatam. Thinks the employment of the hills as sanitaria for the whole army would promote colonization there, as all the men would become acquainted with the hill climates, and many would be induced to settle there. P. 296, Q. 5319–5357.

Dr. HUGH FALCONER—, thinks no station would be favourable for European troops under 5,000 or 6,000 feet. Experiments might be made at lower elevations, but it would not be taking advantage of the conditions within our grasp. The forest should be thinned in low ele-

[N.B.—See note p. 201 *ante.*]

vations before sending up troops. The information already obtained would determine the climatic characteristics of the different elevations. P. 310, Q. 5480–5489.

Dr. SUTHERLAND—, observes that sanitary considerations which have hitherto been overlooked must be equally attended to in the hills as the plains; otherwise hill stations will be of very doubtful benefit. P. 313, Q. 5495; P. 316, Q. 5528-5530.

Sir A. TULLOCH—, considers the placing of troops on high ground is very important as far as it can be done consistently with purposes of defence. P. 317, Q. 5549–5551. Troops at unhealthy places, *e.g.* Allahabad, might be frequently moved to more elevated stations. A large proportion of the troops might be concentrated at elevated stations, now that railways are being laid down. Military authorities should be called upon to state what number of men it is necessary to keep at unhealthy stations. P. 322, Q. 5597–5610. The strictly tropical diseases are not found to prevail in the hill stations, except dysentery and diarrhœa, which probably originate in other localities. P. 324, Q. 5621–5626.

Serjeant-Major WALKER—, states that the soldiers like hill stations, they invigorate the men. To mass the main body of troops on the hills with turns of service with the natives in the plains would be a great advantage to the army. The men have no energy in the plains. Confinement in the barracks from 8 till 4 is irksome to them, they would rather be out in the sun. P. 342, Q. 6014–6023. In the hills all disadvantages of climate would be avoided; the men could be out all day. It is in the plains that thousands of men die. P. 343, Q. 6030–6037.

Dr. DEMPSTER—, agrees with Sir R. Martin that newly-arrived troops should be stationed in the hills, say for three years, descending only occasionally to the plains during the cold season. Meteorological observations have hitherto been very loosely made in India, except at Darjeeling, and by the German brothers Schlagintweit, whose observations may doubtless be found at the India House. P. 463. The course of the seasons at the Landour Convalescent Depôt is as follows:—March is often cold with sudden showers. With April begins summer weather till 20th June, when the lesser rains set in. Heat in shade seldom rises above 74°, but the heating power of the sun is almost as great as in the plains; there is no accumulated heat, however, so that the slightest shade secures a cool retreat, and the cool "Dhoon breeze" sets in about 10 a.m. till sunset. There is a variable interval between the little rains and the regular rainy season, which continues till the middle of September. These are followed by a cool bracing and transparent atmosphere, which is highly salubrious; and the temperature becomes gradually cooler until December and January, when it sometimes freezes and snow frequently falls. Sound European adults and children retain their health here, and the young reduced by illness rapidly recover, but the old and worn usually find their complaints aggravated in the hills. Diarrhœa is the endemic of these regions, arising, he believes, chiefly from suppressed perspiration by sudden change of temperature. Thinks flannel the best prophylactic. Sickly regiments sometimes lose numbers of men on being transferred to the hills. Thinks it would be preferable to send these to such a station as Meerut. Recommends that the change from the plains to the hills should always be gradual; there should be a halting-place half-way, where clothing should be changed. Points out objections

HILL STATIONS.

which may be urged against adoption of hill stations, but is convinced they may be overcome, and many eligible sites discovered by proper search. P. 463.

Dr. **Eatwell**—, considers the question of elevation most important; some are of opinion that elevations of 5,000 or 6,000 feet are preferable to 7,000 or 8,000. He would regard any site below 3,000 with extreme suspicion, except in well-cleared table-land. The deadliest fevers prevail about the bases of, and at low elevations in, hills. This in India attributed to jungle, but on the hill sides at Hong Kong and Amoy, which are bare of trees, the malarious fevers during his three years' residence exceeded in malignity anything he had witnessed in Bengal. Has learned to regard the bases of hills within the tropics as dangerous. Though Bengal is a rice swamp, severe fevers do not generally prevail; but enlarged spleen and agues are common. In China saw an immense amount of fever. Is satisfied that what is called jungle fever may occur independently of the presence of forests. Should insist that mean temperature did not exceed 60°, and that a station should have at least 7,000 feet elevation. The character of the flora is also a good guide. Thinks that the diarrhœa prevalent in the hills depends on local agencies unconnected with elevation,—as dampness, defective ventilation and nuisances, diet, &c. P. 480.

XII.—SANITARIA FOR THE SICK.

SANITARIA.

Sir R. **Martin**—, thinks that for restoring the health of invalids in India a foreign climate should be sought. Australia has been highly recommended.* P. 6, Q. 148–153.

Dr. **Rennie**—, has served six years and a half in Western Australia, where the average temperature is 60° in winter and 75° in summer. There are no extremes; seldom hot in summer more than three days consecutively, and the winter resembles the English summer. The whole colony is healthy. At Fremantle the soil is a light sand; in other parts a light loam, not much cultivated, but capable of being rendered highly productive. There is no part unhealthy. North-westerly winds from the Indian Ocean are most prevalent, from May till October. The rainy season is short, in June and July, the water percolating rapidly through the soil. Swan River, an estuary 14 miles inland, is the only river of any extent. Provisions are plentiful and cheap, both vegetables and cattle. The climate is very exhilarating. The convicts, who are much crowded and over-fed, suffer in the hot weather. There are no diseases peculiar to the country, and the convicts were made healthy by sanitary measures, reduction of diet, and disuse of tobacco, which he considers highly injurious in warm climates. The people attain to great age. Children born in the colony lose their teeth early, which he attributes to their being over-fed on the English system. The natives are rapidly disappearing, their health being deteriorated by change of habits. They now hunt by means of dogs, and have no physical exertion as formerly, and have formed habits of repletion, dram-drinking, and smoking. There were only seven aborigines remaining in Tasmania. The English troops are very healthy. Had addressed a letter to the Army Medical Department,

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* See letters by Dr. Jones and Dr. Fergusson, recommending Western Australia as a sanitarium for troops invalided from India, pointing out the peculiar salubrity of the climate, and the general absence of disease; *e.g.*, no fevers, epidemics, or even syphilis. Addenda 3 and 4, p. 21, 22. See also No. 18, p. 39.

[N.B.—See note p. 201 *ante.*]

SANITARIA.

recommending the formation of a sanitarium at Fremantle for invalids from India.* There is a large convict establishment not needed for that purpose, which might easily be converted into a sanitarium. Steamers from India would occupy from 14 to 21 days in the passage. Pp. 65–71, Q. 827–895.

Dr. COLVIN SMITH—, is of opinion that no foreign sanitarium is required. If men would not recover at the sea coast or hill stations they should be sent home. P. 104, Q. 1581–1582.

Mr. ROE—, considers Swan River well adapted for a sanitarium. It is about three weeks from Calcutta by steam. Regular communication must be first provided.† The temperature is equable; in 1839 the lowest was 45°, the highest 97°. The cost of maintaining a convict is 22*l.* a year; in England it is 28*l.* Provisions are becoming more abundant and cheaper; labour is costly, but roads, &c. are made by convicts. There is plenty of water for domestic purposes, also materials for building. The port and anchorage are good, at all times. The company of troops now stationed there might be dispensed with, were the duty performed by convalescents. There is no opportunity for desertion. The sun is never dangerous; labourers work in it. The rain in winter is abundant. The mortality is remarkably low. Water is obtained from wells and streams. Any amount of ground is available for sites and for exercise. The convict establishment at Fremantle might be converted into a sanitarium. Thinks the climate of King George's Sound not so good as Swan River, and it is not so easily approached by sea. Children born in the colony are not so stout as English children. Among classes not remarkable for temperance children are perhaps neglected, and medical advice is not easily procured. Pp. 112–121, Q. 1805–1922.

Dr. JONES—, thinks the climate of Western Australia the finest in the world, the air being dry, with no continuation of great heat. There is no malaria. Considers it important, men being enlisted for 10 years, to secure their services for the whole period by removing them for a short time from the influences inducing disease in its earlier stages at any period of the year. Much of the expense of invalid depôts and home transport could thus be saved. The mental relief and sea voyage (crossing the line) would greatly assist the cure, and more than compensate for the extra land journey, in preference to removal to the hills in India. The climate of the Cape is similar, but epidemics occur there which do not in Australia. The higher proportion of mortality among children may result from carelessness and the absence of medical assistance in the rural districts. There is a powerfully astringent gum in the colony very effective in diarrhœa. Changes of temperature are not noticed there. Has seen many men in India whose lives might have been saved by removal to Australia. The convicts are over-fed and the cooking is bad. Thinks men might be comfortably conveyed from India to Fremantle for 10*l.* to 15*l.* each. Pp. 121–124, 1923–2007.

Dr. MACLEAN—, considers Waltair, on the coast of Vizagapatam, admirably adapted for a sanitarium and station for that part of the

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* See Addendum, No. 1, p. 71.

† See letter from Sir James Stirling on the climate of Western Australia; contrasting the high temperature, varied by sudden chills, and the moisture prevailing in India, with the comparatively temperate, dry, and equable climate of Western Australia, which is within 14 days from the nearest Indian ports, and therefore suggesting establishment of a sanitarium, from which troops may readily be recalled by telegraph. Addendum, No. 8, p. 120. See also various statistics and opinions, Addenda 1–7 and 9, 10, pp. 117–121.

[N.B.—See note p. 201 *ante.*]

SANITARIA.

country, being open on three sides to the sea and protected by mountains on the fourth. The climate is equable, and there is no fever there. P. 138, Q. 2296–2300. In severe cases the sick must be sent to sea. Has a high opinion of the Cape. Has no experience of Australia, but many cases would be cured in such a place, and a sanitarium of that kind is required. It is lamentable to see the number of lives lost for want of it, "waiting for death" in hospital. The probability is, that a large majority of such would be rendered efficient merely by the voyage, if ships be properly provided.* P. 142, Q. 2363–70.

Sir **JAMES STIRLING**—, has had twelve years' experience of Western Australia. The climate is exceedingly healthy. Screw steamers would make the passage from Calcutta in 14 or 16 days. King George's Sound is the finest climate, but Swan River would be the most accessible. The heat is never injurious to health as it is exceedingly dry; the people labour in the fields without injury. For building, convicts would be available, or coolies from India. Provisions might be supplied to meet any demand. Fruits and vegetables would be excellent and unlimited. Two companies were formerly stationed in the colony; believes the number has been increased; convalescents from India might perform their duty. The cost of transport would be about 10*l.* per man, and vessels should be specially devoted to that service. Sick might be landed in Australia at all seasons, and would recover their health even in the heat of summer. The voyage would be lengthened and more boisterous by going round to King George's Sound, though that is the best climate, wonderfully equable. Large vessels might not feel it. There would be no difficulty in the landing at all times at either place, but King George's Sound has the best accommodation perhaps. It is a very fine harbour. Pp. 211, 212, Q. 3352–3412; see also Addendum 8, p. 120.

Dr. **BIRD**—, considers that debilitated men from malarious and coast districts should be sent to maritime sanitaria, as Vingorla, Bassein, Poorbundhur, and Kurrachee; and probably the Sandheads for Lower Bengal. P. 221, Q. 3602. Remittent fevers and inflammatory visceral cases should be sent to sea or a coast station; or the Cape, Prince of Wales Island, or Western Australia. P. 223, Q. 3649. Invalids should be landed at the Cape as an intermediate station. A sanitarium should be established for the complete restoration of men sent down to the coast, who are often sent back to their regiments too soon, and die in consequence. P. 224, Q. 3669, 3670.

Brig.-Gen. **RUSSELL**—, thinks that if men proceeded to sanitaria as officers do it would be a great advantage. They go only once a year, and when the time comes it is often too late. A regiment on arriving at Trichinopoly from the Cape suffered considerably from dysentery. It is now admitted that the Cape is a bad preparation for India. P. 230, Q. 3791, 3792.

Mr. A. **GRANT**—, would use hill stations as sanitaria in moderate cases of organic disease. Severe cases should be sent to sea. P. 261, Q. 4472, 4473.

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* Dr. **MACPHERSON**—, strongly recommends Curlew Island, in the Bay of Bengal, for a sanitarium, Addendum, p. 483. The Chirrapoonjee Committee remark that sufficient attention has not been paid to the salubrity of the roads leading to sanitaria. (Appendix, p. 147.) The Ahmednuggur Committee consider good sanitaria along the Bombay coast to be a great want. These would often be preferable to hill stations. (Appendix, p. 838.) Mr. Hare recommends that invalids from India should often be drafted into regiments serving in cold climates, for three or four years, after which they might return to India. (Appendix, p 183.)

[N.B.—See notes pp. 201 and 202 *ante.*]

XIII.—DISINFECTING AGENTS.

DISINFECTANTS.

Dr. ANGUS SMITH—, states that by the use of antiseptic disinfectants the decomposition of organic matter may be prevented, so that manure, &c. may be preserved without giving off injurious gases. Instances experiments on sewers in London and at Carlisle, by Mr. McDougall, of Manchester. This would be invaluable in camps and military stations to prevent nuisance previous to the removal of foul matters. If applied to land, antiseptics will also arrest all animal and vegetable decomposition in the soil, without which malaria will not arise. The destruction of insects is another result; limited districts of country might be disinfected by this means with greater ease than corn is sown. The best disinfectant is McDougall's powder and fluid. The true discovery of the chief ingredient (carbolic acid or creosote) belongs to Baron Reichenbach, who obtained it from wood. Runge got the same from coal. The extension of its use to sewage, &c. was due to himself (having no commercial interest in it) and Mr. McDougall. It is exceedingly cheap; a few pence would provide sufficient for an acre of land. If used in India it might be prepared there from wood. Thinks the soil to which it was applied would soon get into a more wholesome condition; for surface impurities the effect would be instantaneous. This differs from Condy's disinfectant, inasmuch as it does not oxidize or destroy the manure, and is much less expensive. Considers that for 15,000*l*. a year the whole of London, including streets, sewers, and the Thames itself, might be completely disinfected. The powder made by Mr. McDougall had been used very beneficially in the transport of horses to the Crimea; but some sent to the army there was not allowed to be used, being returned, and sold as old stores. Camps may be readily disinfected by this means. It might also be useful on turning up fresh land, *e.g.*, for railways or clearing jungle. Pp. 155–162, Q. 2687–2741. The air test which he uses will determine the amount of organic matter in any given atmosphere. There is putrefying matter deposited on the walls and glass of ill-ventilated rooms, which may be detected by this means, and by which the chief evil of overcrowding is occasioned. P. 164, Q. 2769–2772.

Dr. LETHEBY—, states that Condy's fluid (permanganate of potash) has a very good effect for disinfecting purposes in barracks and hospitals, although it is rather expensive when used in sufficient quantity for such a purpose. P. 267, Q. 4608. There are several disinfectants that will stop putrefaction and enable sewage to be removed without danger, McDougall's fluid being the most useful, which has been tried in the London sewers with a good effect. It is very inexpensive, and prevents putrefaction without destroying the organic matter, which Condy's solution does. P. 269, Q. 4690–4703.

Mr. SIEBE—, describes Harrison's ice-making machine as capable of producing from 10 to 20 tons of ice per day, at 10*s*. per ton. Ether and salt are the articles used. The air of rooms may also be cooled by this process. P. 326, Q. 5659–5672. The machine is already used in some of the Bengal hospitals, on which a report from the Calcutta Gazette is appended.* P. 327.

XIV.—TRANSPORT OF TROOPS.

TRANSPORT.

Sir R. MARTIN—, states that the climate traversed between England and India, being the finest in the world, if the ship be under proper re-

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* See Mr. Julius Jeffreys' remarks on the ice-making process, and plan of water mill for working same, pp. 495–6.

[N.B.—See note p. 201 *ante.*]

TRANSPORT.

gulation, the soldier ought to arrive in the best health. The overland route is rapid, and has not these advantages, so that as regards health the Cape route is preferable. The diet on board ship might be improved. Pp. 7, 8, Q. 193–200. Railways in India will be of great benefit to the health of the army by affording speedy transport to the hills. P. 8, Q. 203. Neither recruits nor invalids should be detained at Calcutta, but sent direct to or from the river steamer, from or on board the home-bound vessel; much drunkenness and injury is caused by their detention. P. 17, Q. 277–280.

Dr. **DUNCAN STEWART**—, states that recruits for India embark in detachments of from 200 to 350, having enlisted generally for cavalry, infantry, or artillery, and they are distributed to regiments and localities on arrival. P. 48, Q. 605. Upwards of 4,000 recruits are sent from Warley annually. The Cape is undoubtedly preferable to the Suez route for recruits. The arrangements for the voyage are excellent; nothing can be better. 6,189 men, 144 women, and 99 children went out, divided into 29 embarkations, in 1858. Considers it would be disadvantageous to stop the men at the Cape for drill. P. 50, Q. 612 –626 *a*.

Dr. **MCLENNAN**—, considers the Cape route the best, except that in the autumn troops for Bombay might advantageously go by the Red Sea; it is too hot in the summer. Men should arrive in December and January, having first been drilled in England. P. 93, Q. 1286–1290.

Dr. **MACLEAN**—, has known much suffering among sick soldiers on board ship from such an apparent trifle as mal-position of waterclosets. P. 142, Q. 2370.

Dr. **BIRD**—, thinks great improvement might be effected both as to diet and clothing on board transports to India. Diseases are caused by salt provisions, spirits, and unsuitable dress; porter is also objectionable. P. 218. Q. 3541-3548.

Colonel **DURAND**—, is of opinion that suffering and loss might be reduced by attention to the countries from which troops are sent to India; the period of arrival in India; and the mode of conveying troops from the points of debarkation.* P. 287, Q. 5162.

Sir A. **TULLOCH**—, states that at the present rate of mortality in India, and to maintain an army of 80,000 men on the ten year relief system, it will be necessary to find passages for about 30,000 men annually, at a cost of 300,000*l.*; but if more healthy stations be selected more relief men would volunteer into other regiments, and time-expired men would re-engage. P. 323, Q. 5611–5620.

Dr. **DEMPSTER**—, is of opinion that on the voyage spirits should not be allowed, and a moderate allowance of light malt liquor substituted. Europeans should arrive in India during the cold season; the middle of November being the earliest period, which allows three and a half months for moving up the country, either on the march or by railway. Strongly objects to river transport, over-crowding, productive of cholera, being the result. P. 463.

XV.—THE MEDICAL SERVICE.

MEDICAL SERVICE.

Sir R. **MARTIN**—, says the Indian medical service is well ordered for the purposes of cure, but the sanitary department is altogether want-

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* The Rangoon Committee advise that the soldiers on the passage out should be partially drilled and made to assist the sailors in various ways, to keep them in exercise. Major Haly refers to bathing-parades which he had enforced on board ship, the men being placed in ranks and washing each other according to systematic drill, described. (Appendix, p. 537.)

[N.B.—See notes pp. 201 and 202 *ante.*]

MEDICAL SERVICE.

ing.* Candidates should pass through a good school of military hygiene in England. Has advised that they should have the benefit of instruction at Chatham. There are no sanitary regulations, and medical officers have at present no power to enforce attention to such matters. Describes the medical organization generally. Pp. 14, 15, Q. 216–240. Instruction is required as to invaliding rules for officers and men. The old invaliding boards are unnecessary. P. 17, Q. 275, 276, 281.

Col. SWATMAN—, observed that medical officers can only suggest sanitary improvements, but the suggestion would be attended to whenever practicable; if not expensive works on a large scale must go through the usual routine to the higher authorities. Commanding officers frequently consult surgeons as to marching and halting of the men, but it is not done by order. P. 46, Q. 517–531.

Dr. MCLENNAN—, describes the Bombay hospitals as having a very full and efficient establishment; recommends a slight addition in the allowances made to the warrant officers, and that the ward attendants should be permanently enlisted. P. 92, Q. 1284. Medical officers report daily as to sanitary state of the regiment; weekly, monthly, and yearly to medical superiors; besides special reports. Medical officers [cannot be appointed presidents of committees under the regulations; an unnecessary indignity which ought to be removed. Pp. 94–95, Q. 1307–1313.

Dr. COLVIN SMITH—, states that cleansing is well attended to in the hospitals and the dressers' department in Madras is very good. The artillery had a female hospital with a good matron; bad lying-in cases were admitted. P. 105, Q. 1602–1606. Thinks the medical officer should have more authority on sanitary questions; and there should be sanitary committees at all stations, presided over by a sanitary or medical officer of health. Pp. 105, 106, Q. 1621–1635.

Mr. LONGMORE—, states that new "temporary" barracks at Barrackpore were about to be erected in a wrong position, against the advice of the medical officer, until by his own interference a medical committee was assembled and the matter set right, it not being considered necessary to consult medical men as to temporary arrangements. P. 132, Q. 2186–2188. The appointment of a sanitary officer at Calcutta was producing much good; reports were made weekly and immediately attended to. This office having been abolished on reduction, there is no one who can attend to the work, and it is not done. Pp. 133, 134. Q. 2209–2216.

Dr. MCCOSH—, considers that Indian medical officers should be promoted earlier. There are now assistant-surgeons of 17 and 18 years' service. There is not a due proportion of surgeons. In every other branch of the service there is a comparative increase in the higher grades. Another grievance is that the surgeon-major receives no higher pay than the surgeon. In no other service does an officer remain 17 or 18 years in the first grade. The average in the English army is seven or eight years. These things have promoted chronic discontent, and no eagerness is shown to enter the service. Again, no assistant-surgeon can obtain a pension under 17 years' service. The subordinate branch of the medical department is in a satisfactory state. Medical officers have not sufficient power to ensure attention to sanitary recommendations when commanding officers are not alive to such matters. Gives an illustration. This, however, is the exception. Pp. 153, 154, Q. 2647–2683.

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* See Suggestions, p. 19, "Lastly," &c.

[N.B.—See note p. 201 *ante.*]

MEDICAL SERVICE.

Colonel GREATHED—, states that in case the commanding officer did not attend to the recommendation of the medical officer, he would report to his superintending surgeon, who can bring it before the general of division. The suggestions of the medical men are usually attended to very implicitly. Has never seen any difficulty, or a medical opinion trifled with. Pp. 207, 208, Q. 3273–3281.

Dr. BIRD—, is of opinion that a medical officer should be sent down to the coast with invalids in order that the medical board might have more knowledge of the cases, and the men should not be delayed at the presidency. Would not dispense with the final board, who should be selected by the Commander-in-Chief. Does not think that officers who have served with natives only, unless very intelligent, would be as well suited to supervise Europeans as officers of experience with Europeans ; but that the medical officers with native troops are very intelligent. P. 225, Q. 3673–3684.

Mr. A. GRANT—, considers that experience in India is necessary to enable a medical officer to become familiar with the diseases of the country. Knows of no more responsible charge than the care of a British regiment in India. The medical officer requires friendly advice and assistance from experienced medical superiors. Pp. 263, 264, Q. 4527–4535.

Sir C. TREVELYAN—, had succeeded in establishing a school for dental surgery at Madras, in connexion with the hospital,—considering the care of the teeth, which has hitherto been neglected, of great importance to the soldier. A tooth-brush should be added to the kit. P. 293, Q. 5285–5288. Suggests that a manual should be prepared of the conclusions arrived at concerning the sanitary state of the army in India, so as to be available for every medical and military officer, as it is very difficult to extract the existing state of knowledge from lengthy treatises and reports, &c. Every officer who serves in India should be expected to master this treatise. P. 301, Q. 5361–5362.

Dr. SUTHERLAND—, observes that according to the returns the Indian medical officers have hitherto had no definite powers as to sanitary matters. The medical regulations issued by Lord Herbert, 7th October 1859, would effect immense good in India. To the absence of any sanitary system is to be attributed much of the great prevalence of disease and high mortality both among Europeans and natives, the surgeon generally not having been educated for such duty. The sanitary administration should be a special one ; a separate one for each presidency, which should be also applied for the advantage of the population. P. 313, Q. 5495–5507.

Dr. DEMPSTER—, states that the subordinate hospital assistants are generally "Eurasians" of low moral character, and considerable peculation is the consequence. These men usually prepare the returns and indents for supplies, whereby much fraud is practised. Youths educated at the Lawrence Asylum might well be substituted for those at present employed in this service. P. 477. The Bengal dooly is superior to that used in Bombay ; but ambulances should be provided for conveying the sick. P. 478.

By Order of the Commissioners,
(Signed) T. BAKER.

LONDON:
Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.